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13. SUPPLEMENTARY NOTES

14. ABSTRACT
We will develop the checklists for the POIP using cognitive systems engineering methodologies and iteration. To validate the model, we will measure clinician perception of patient condition and care priorities; we will observe the frequencies that healthcare teams complete key elements of patient care; and we will measure communication, teamwork, cognitive work load, and provider quality of life before and after units implement the POIP. To assess the model's effect, we will observe patient outcomes and complication rates before and after units implement the POIP. To further assess the model's capacity to rapidly incorporate new knowledge into burn critical care, we will update the phase specific checklists six months after initial implementation and continue data collection.

15. SUBJECT TERMS
Team Communication, Burn Intensive Care, Illness severity, Care Goals, Clinical Decision Support Tools, Phases of Illness, Cognitive Workload, Quality of Life, Card Sorting

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A. Introduction

This project seeks to validate the phases of Illness paradigm (POIP) (Pamplin 2011) and its effect on a variety of measures in three Burn ICUs. This paradigm describes patients with similar illness severity for which clinicians define standard goals of care, treatment objectives, and specific care tasks. Checklists may help to identify a patient's illness severity and priorities of care as they progress or regress through the continuum of illness during their time in the ICU. Within each "phase of illness" – or range of illness severity – phase-specific checklists may help ensure adherence to local protocols, best practices, clinical guidelines, and specific care bundles. These checklists may help to standardize supportive care elements such as types of monitoring, frequency and type of laboratory assessment, sedation strategies, modes of mechanical ventilation, and physical therapy interventions. Through this standardization, the POIP may create a shared mental model of patient care amongst clinicians in the BICU and thus enhance distributed cognition (Hutchins 2000) and assist the work of the multidisciplinary ICU care team. The objectives of this program are as follows:

a. Understand the work domain in the Burn ICU in terms of patient condition, patient progress, and dependent clinician behaviors in order to create ecologically valid checklists that support clinician work including decision making according to the Phases of Illness Paradigm.
b. Validate the Phases of Illness Paradigm and its effect on a variety of measures in three Burn ICUs
c. Implement the POIP to improve the multidisciplinary burn ICU team's understanding of patient illness severity, daily care priorities, and anticipated care goals.

B. Keywords

Team, Communication, Burn Intensive Care, Illness severity, Care Goals, Clinical Decision Support Tools, Phases of Illness, Cognitive Workload, Quality of Life, Card Sorting

C. Overall Project Summary

This project seeks to understand the work domain in the Burn ICU in terms of patient condition, patient progress, and dependent clinician behaviors in order to create ecologically valid checklists that support clinician work including decision making according to the Phases of Illness Paradigm. We will implement the POIP to improve the multidisciplinary burn ICU team's understanding of patient illness severity, daily care priorities, and anticipated care goals. This project aims to validate the Phases of Illness Paradigm and its impact on a variety of measures in three Burn ICUs. In addition, we aim to further develop the Phases of Illness Paradigm by investigating the ecology of clinical behaviors in the team environment it is meant to support. Using surveys, we will evaluate the perception of the clinicians implementing the checklists on teamwork and communication effectiveness.

The objectives of this program are as follows:

a. Implement the POIP to improve the multidisciplinary burn ICU team's understanding of patient illness severity, daily care priorities, and anticipated care goals.
b. Understand the work domain in the Burn ICU in terms of patient condition, patient progress, and dependent clinician behaviors in order to create ecologically valid checklists that support clinician work including decision making according to the Phases of Illness Paradigm.

c. Validate the Phases of Illness Paradigm and its effect on a variety of measures in three Burn ICUs.

The project tasks are as follows:

TASK ONE: Describe the patient progress through intensive care from patient-centric and provider-centric perspectives. This will include identification of general patient characteristics, provider perspectives, care priorities, therapeutics, activities, and care team goals at various times during a notional patient's progress through intensive care.

TASK TWO: Using the information discovered in task 1, create a representation that maps patient progress through the ICU in the form of checklists that identify patients' and care team goals, objectives, and tasks that are commonly associated with a patient's current condition (i.e. "phase of illness").

TASK THREE: Implement the phases of illness paradigm in three Burn Centers and assess its impact on provider understanding of patient status, care priorities, patient outcomes, and effect on communication, teamwork, quality of life, and cognitive workload. Comparative data for providers and patients will be obtained/initiated throughout the project beginning in month 3.

TASK FOUR: Review and update the Phases of Illness Paradigm (POIP) checklists and assess the time it takes for new checklist items to be reliably completed without new/additional education for the healthcare team.

1. Gantt Chart

Task #	Activities	Deliverable or Milestone	Year 1				Year 2				Year 3	
			1	2	3	4	1	2	3	4	1	2
	Checklist Development											
1	Questionnaire & Interview	Pre-baseline data regarding clinician perspectives										
2	Data analysis	Initial checklist representation of patient phases										
3	Iterative checklist development	Finalized POIP checklists										
	POIP Implementation and Prospective Data Collection											
4	Baseline data collection	Baseline data regarding clinician perspectives										
5	Eduaction and Implementation of POIP	Acceptance of new paradigm in clinical work										
6	Application of the POIP in clinical work	Ongoing use of POIP checklists										
7	Mid-point data collection	Mid-point data regarding clniician perspectives										
8	Data analysis	Initial updated checklist representaiton of phases										
9	Iterative checklist development	Finalized update to POIP checklists										
10	Implementation & use of updated checklists	Ongoing use of POIP checklists										
11	Final data collection	Final data regarding clinician perspectives										
	Data analysis and Presentation											
12	Final data analyasis and presentation of work	Published data										

Key: red line = Core Site progress; purple line = Houston Site progress; dark blue line = Dallas Site progress

2. Project Summary by Task

TASK ONE. *Describe the patient progress through intensive care from patient-centric and provider-centric perspectives. This will include identification of general patient characteristics, provider perspectives, care priorities, therapeutics, activities, and care team goals at various times during a notional patient's progress through intensive care.*

Data collection for provider-centric perspectives was completed last year at all three sites. Data regarding the patient-centric progress through intensive care will be more thoroughly evaluated using retrospective data obtained during the study period at each participating institution. While there is no additional data at this time, further analyses of previously collected data remains ongoing and continues to reveal confirmation of findings previously reported as well as new insights.

Indeed, mental models that clinicians use differ widely with respect to patient condition and care priorities. We investigated this using two different "surveys," card sorting (i.e. the "clinician card sort test" or CCST) and a "clinician understanding survey" or CUS. In both tests, we asked clinicians to identify the illness severity of a a patient they were caring for by placing a mark on a horizontal spectrum that represented the continuum from "most sick, could die today" to "least sick, could transfer today." This scale is shown in figure 1. Figure 2 shows representative examples of two patients for whom multiple clinicians were surveyed (in these examples, the survey was the card sort test).

Figure 1. Scale used by clinicians to rate a patient's current condition or "illness severity." The blue line would have been made by a clinican before compling a card sort or a condition understanding survey. This scale may be divided into 10 equal parts and used to compare a clinician's perception of patient condition to other clinicians caring for the same patient (see below).

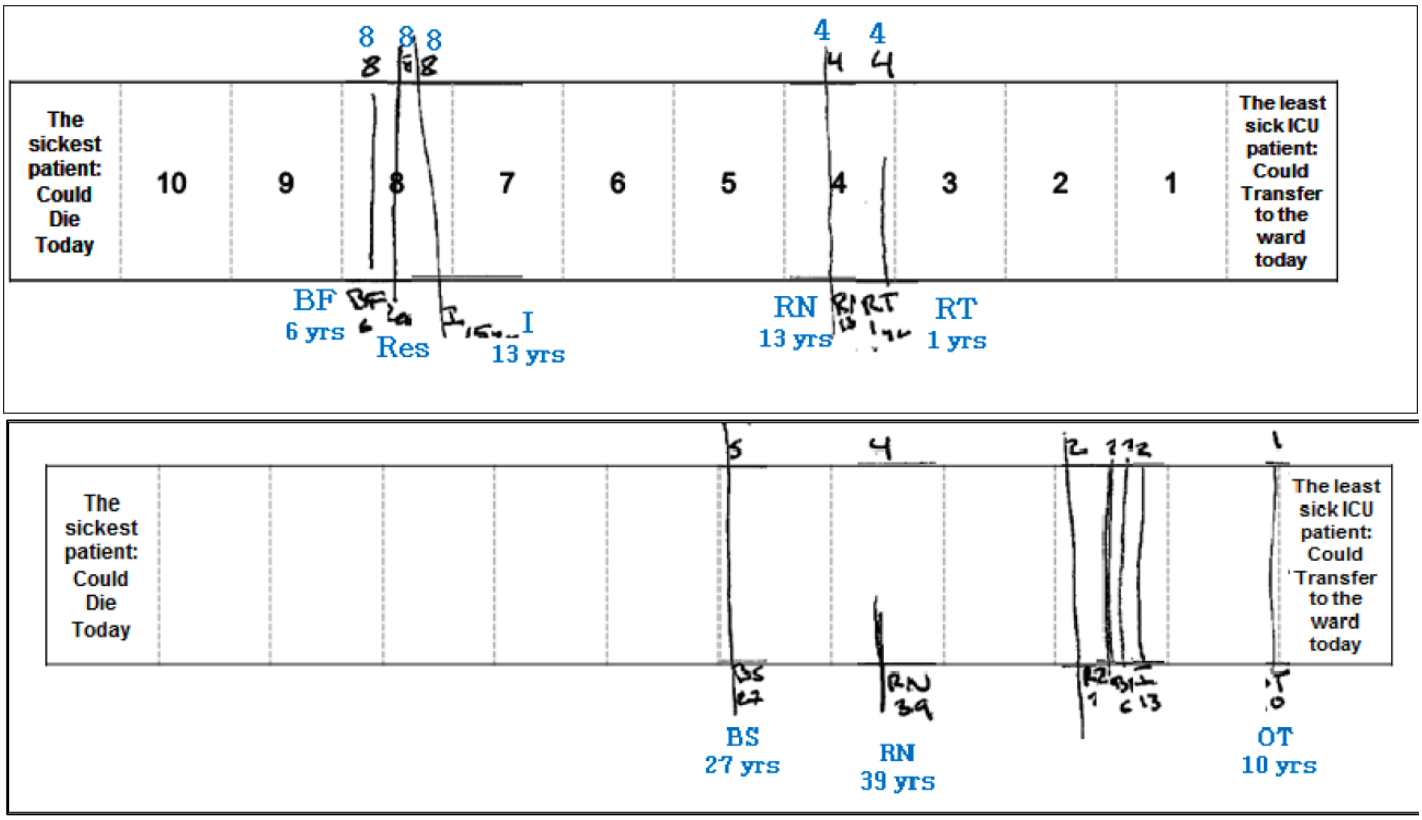


Figure 2. Examples of differences clinician perception of patient condition or illness severity. Clinicians individually marked blank scales as in Figure 1. These two examples are synthesized from multiple individual scales to show the differences in clinical perspective about two different patients. In the top example, five clinicians rated the patient. The average score was 6.4 (range 4-8). In the bottom example, seven clinicians rated the patient. The average score was 2.5 (range 1-5). Both examples represent significant differences in clinical perspective about patient condition that could impact clinical decision making about care goals, care priorities, clinician activity synchronization and planning, and, ultimately, patient outcomes.

Interestingly, but not surprisingly, clinician perception about patient condition is more consistant (aligned) when patients are most sick and when they are least sick. Figure 3. Shows the variability (in terms of standard deviation) of individual illness severity ratings compared to the average illness severity rating for patients whom at least five clinicians rated. The main conclusion from this analysis is that the greatest potential for clinicians to disagree about a patient's condition exists when patients are "middle sick."

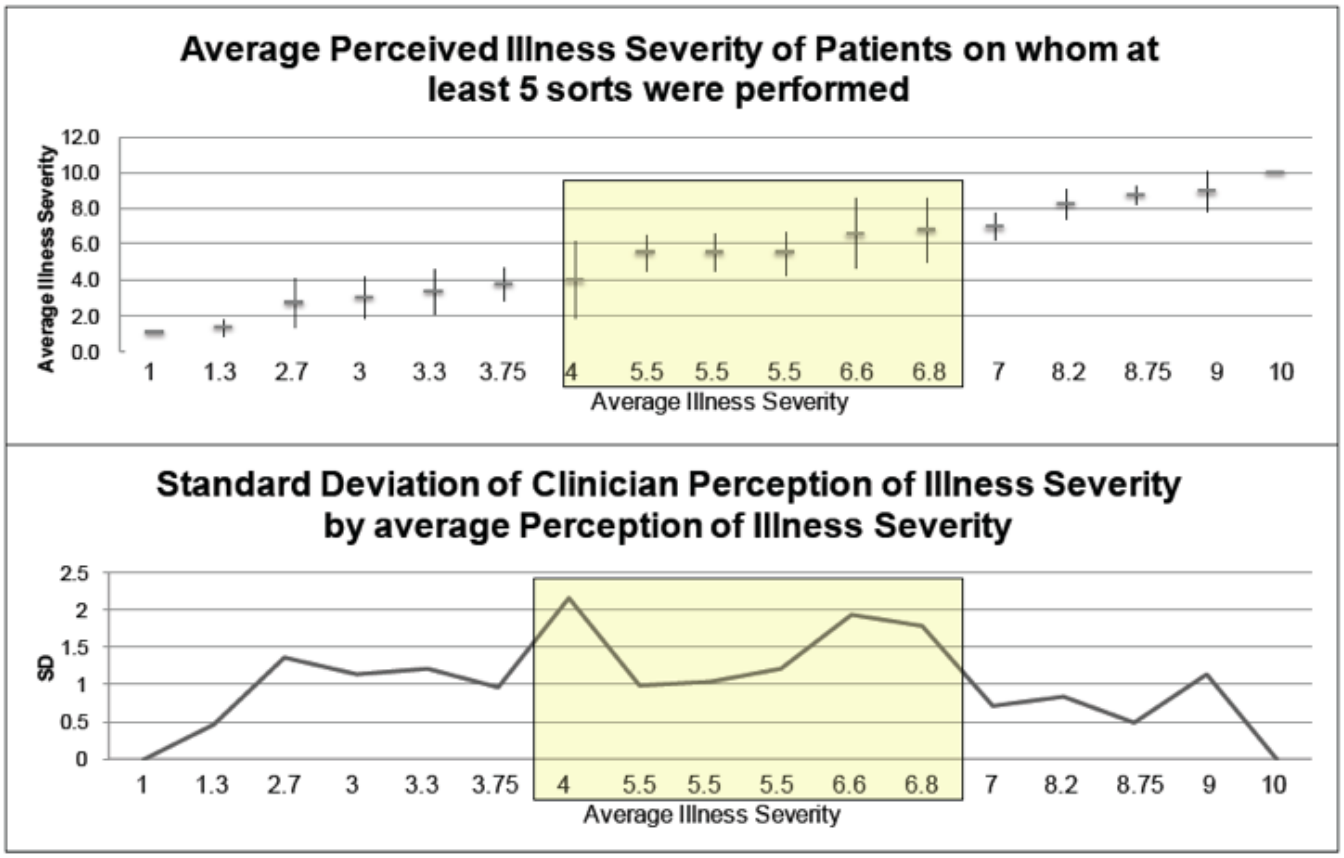


Figure 3. Standard deviation of illness severity ratings for comparisons of at least five individual clinician ratings. Variance of clinician perception is greatest in "middle sick" patients (average illness severity scores between 4 and 7). Ranges of individual ratings were has high as 4 points different as in the examples in figure 2.

Perceptions about clinician information use and prioritize to make judgements about patient condition was also collected during the CCST. Although this data continues to be analyzed, the initial reviewed also demonstrated notable differences in how clinicians of different clinical backgrounds (i.e. nurses vs. physicians) and of difference experience levels (i.e. attending vs. resident) use information to make these judgements. A simple method for displaying these differences are word clouds. Although these are not a traditional format in medical literature, social sciences use them to demonstrate thematic differences between groups or to reveal patterns. In the word clouds shown in figures 4 and 5, words size represents the frequency (i.e. picks/subjects) that a card was selected to assess patient condition. Information frequency also changes by illness severity; in other words, some information is prioritized more frequently to assess patient condition if a patient is more vs. less sick (data not shown).

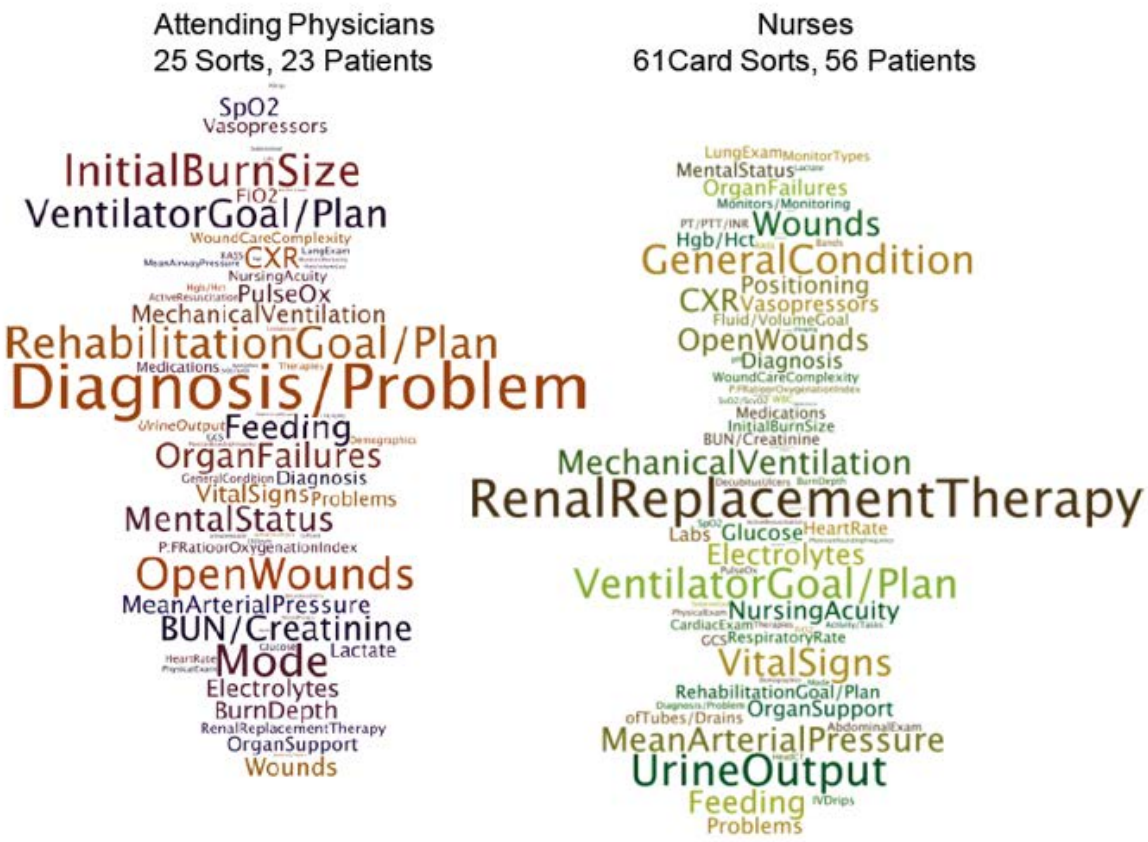


Figure 4. Comparison of word clouds generated from attending physician and nurse card sorts. Relative word size represents the frequency that information element was chosen to form an assessment of a patient's illness severity. Larger words were chosen more frequently than smaller words. Attendings appear to focus more on problems, diagnoses, categorical ideas (i.e. organ failures, mental status, ventilator mode), plans and goals to assess patient condition whereas nurses appear to be less consistenent of focus, evidenced by smaller, more numerous words, and seem to focus on more data driven information elements (i.e. vital signes, urine output, blood pressur), acuity/workload (i.e. renal replacement therapy, mehancical ventilation and its plan), and gestault (i.e. "general condition") to make these assessments.

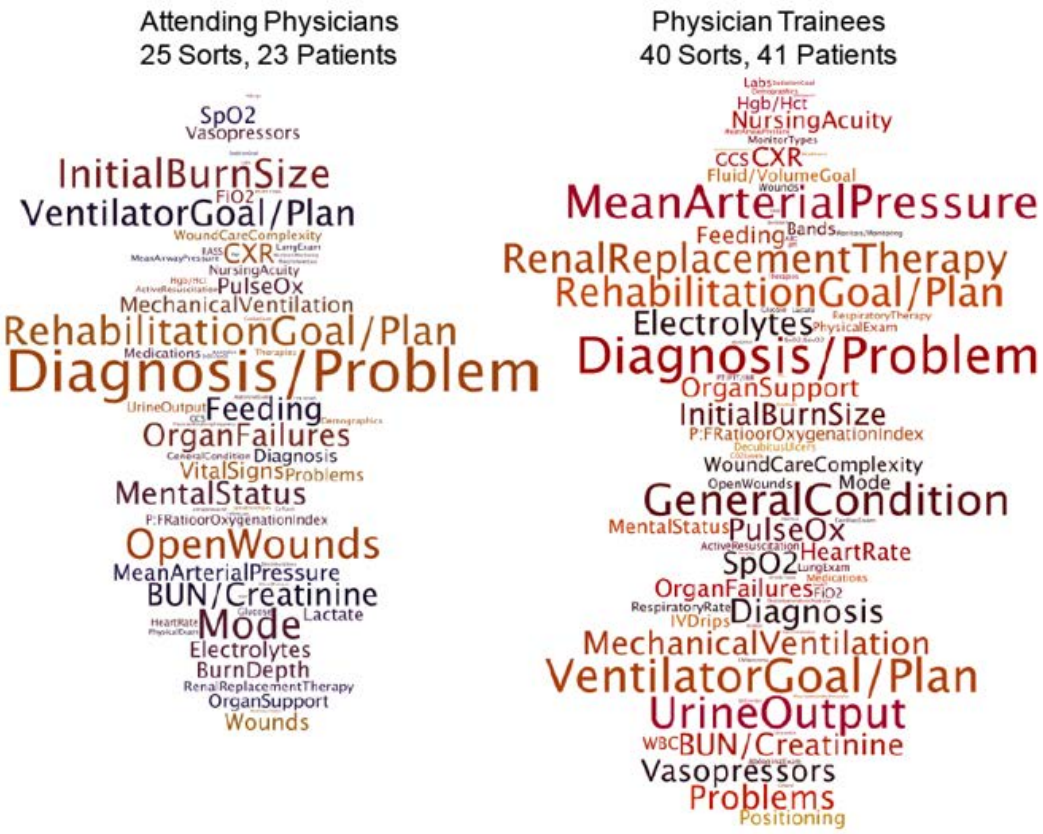


Figure 5. Comparison of word clouds generated from attending physician and resident card sorts. Relative word size represents the frequency that information element was chosen to form an assessment of a patient's illness severity. Larger words were chosen more frequently than smaller words. Interestingly, residnets (less experienced physicians) chose more information sources, and more cards overall, than did attending physicians as evidenced by the larger word cloud. Resident physicians seem to have difficulty focusing on any particular information source or concept when making assessments of patient illness severity.

As part of the CCST, clinicians were also asked to describe their patient using key terms. Some key terms were identified during CCST tool development through in depth interviews with clinician experts. These were offered to subjects completing CCSTs for simplicity (i.e. they could circle terms they would use), but clinicians were also permitted to offer their own terms. In general, clinicians chose multiple terms to describe their patients (5+/-2 terms on average). Very few terms had any discriminatory power for identifying patients of any particular illness severity. An apparent pattern does exist (see Figure 6), but it is clear that clinicians in three burn ICUs lack a common language that could help clinical teams perceive patient condition more consistently.

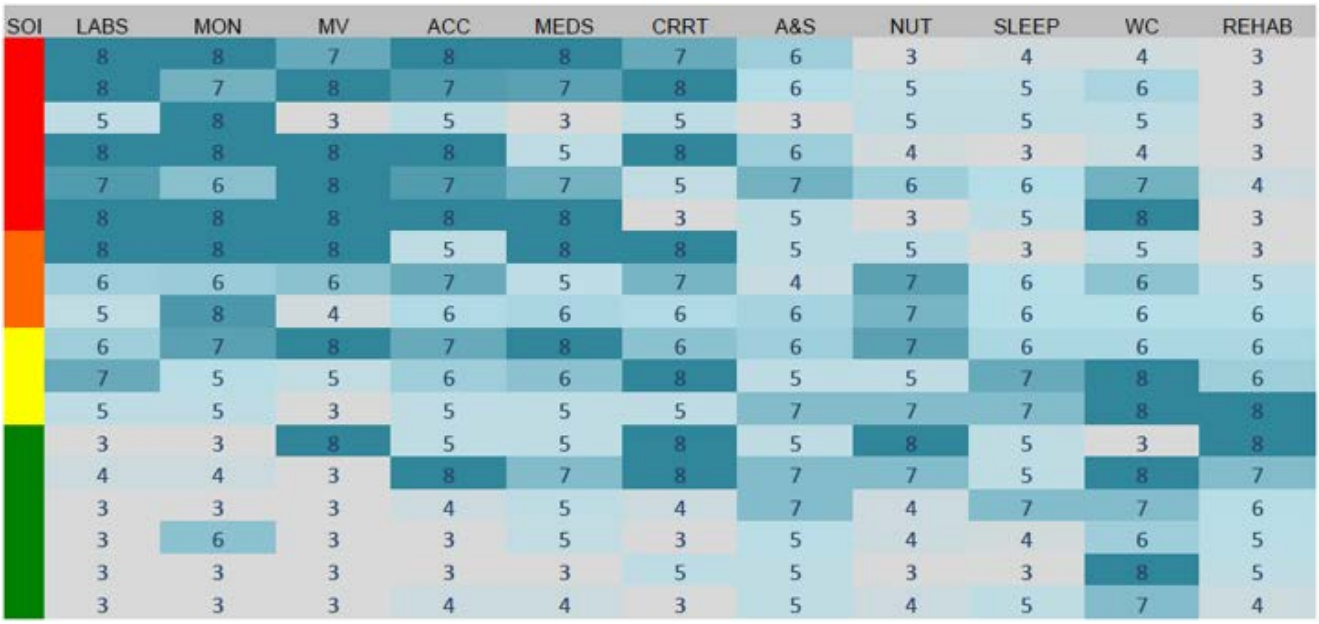
#surveys/group	11	13	16	20	23	15	25	25	13	8	169			
Illness Severity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	Term Count	Mean Severity	A Priori Strength within Group	Final Strength within Group
Ready for transfer	91%	38%		5%				4%			17	1.9	0.34	0.34
Not Sick	9%	8%	19%								5	2.4	0.13	0.13
Just Monitoring	9%	15%	6%	10%		7%					7	3.1	0.06	0.06
Getting Better	45%	85%	31%	30%	17%	13%	4%	8%			36	3.4	0.32	0.32
Stable	73%	38%	75%	70%	30%	20%	8%	8%			53	3.6	0.27	0.27
Improving	55%	77%	69%	30%	39%	7%	12%	16%	8%		51	3.8	0.34	0.34
Going in the right direction	55%	69%	56%	50%	48%	20%	16%	12%	15%		57	4.1	-0.37	0.15
Normotensive	36%	15%	44%	30%	22%	27%	28%	8%		13%	38	4.7	-0.13	-0.13
Stabilized	27%	31%	25%	40%	30%	53%	28%	8%	8%		44	4.8	0.02	0.02
Medium Sick	18%	8%		35%	30%	20%	12%	8%			25	4.9	0.12	0.12
Ventilated	9%	15%	44%	55%	61%	53%	72%	60%	69%	38%	88	6.2	-0.22	-0.22
Infected	9%			20%	17%	27%	36%	24%	38%	13%	34	6.7	-0.03	-0.03
Critically Stable			6%	5%	43%	40%	64%	48%	15%	13%	49	6.7	0.05	0.05
Getting Worse				5%		7%	12%	20%	23%	13%	14	7.7	-0.14	0.14
Profound lung injury		8%		5%		7%	4%	20%	38%	38%	17	7.9	-0.27	0.22
3+ sick					4%	7%	4%	12%	23%	13%	10	7.9	-0.12	0.12
Profoundly ill				10%		7%	28%	40%	85%	25%	33	7.9	-0.38	0.38
Most Interventions				5%		7%	16%	24%	23%	50%	19	8.1	0.21	0.21
Multiple Organ Failure				5%	4%	7%	4%	24%	23%	50%	17	8.1	0.23	0.23
In Shock							4%	4%	31%		6	8.5	0.10	0.10
The sickest patient						7%	4%	28%	38%	88%	21	8.8	0.39	0.39
Shock Like								4%	23%	13%	5	9.0	0.11	0.11
Actively trying to die								4%	8%	25%	4	9.3	0.09	0.09

Figure 6. Contour plot showing the frequency of terms chosen according to patient illness severity as indicated by clinicians. Percentage = the count of a term divided by the number of surveys/illness severity score. Also shown are the number of times a term was chosen overall (**term count)**, the mean illness severity for which a term was choses (**mean severity**), and the difference between the frequency a term was chosen within the A Priori Group (least sick = 1-3, middle sick – 4-7, most sick = 8-10) and Final Group (where most sick = 7-10) vs. outside the group (**strength within group**). This statistic helps differentiate terms that are used often (i.e. by many clinicians) and are consistent with a particular illness severity group. Of note, illness severity in reality is not discrete: it represents a continuum of patient condition. Here, we try to demonstrate that with a gradient of color whereas in the analysis we uses three discrete groups.

Patterns of care priorities were discussed with and described by clinicians during the second group interviews that were designed to validate the POIP model. As shown below in figure 7, clinicians alter care priorities according to their perception of patient condition. Laboratory evaluation, monitoring, mechanical ventilation, venous access, and medication management (i.e. ensuring the patient is on the correct medications) are all more prioritized in sicker patients whereas optimizing nutrition, sleep, wound care, and rehabilitation are all more prioritized in less sick patients. After evaluating patient cases, clinicians identified patient condition and then rated care elements accordint to highest, middle, and least prioritie. Highest priority was given a numerical rating of 8, middle priority a rating of 5, and lowest priority a rating of 3. Prioties were then averaged for call clinicians evaluating a patient as the same level of illness (not necessarily grouped by case). Thus, the representation in figure 7 depicts the clinician perception of care priotity according to patient illness severity, not according to the patient case presented. Some care elements may have a bimodal importance (i.e. mechanical ventilation, venous access, and wound care). When discussed, this patter generally reflected the following positions: when patients are “sicker” mechanical ventilation is added or increased in support, when they improve mechanical ventilation is weaned or discontinued. Similarly, venous access is added and removed when patients worsen or improve respectively. Finally, wounds must be thoroughly evaluated when patients worsen and wound care optimized when patients are improved/improving to prevent complications – also, patients tend to be more perioperative in middle illess categories. Renal replacement therapy seems to be generally important whenever it is utilized for any degree of patient illness. Similarly, analgesia and sedation, while not the highest priority at any time, remains a consistnely priority during all phases. Summing all of the priorities, even with relative scores, produced a rank-ordered list of overall care priorities of clinicians in the BICU:

1. Wound Care
2. Renal Replacement Therapy
3. Vascular Access & Monitoring
4. Medication Management
5. Laboratory Evatulation, Analgesia, & Sedation
6. Mechanical Ventilation
7. Nutrition

8. Sleep
9. Rehabilitation



SOI	LABS	MON	MV	ACC	MEDS	CRRT	A&S	NUT	SLEEP	WC	REHAB
	8	8	7	8	8	7	6	3	4	4	3
	8	7	8	7	7	8	6	5	5	6	3
	5	8	3	5	3	5	3	5	5	5	3
	8	8	8	8	5	8	6	4	3	4	3
	7	6	8	7	7	5	7	6	6	7	4
	8	8	8	8	8	3	5	3	5	8	3
	8	8	8	5	8	8	5	5	3	5	3
	6	6	6	7	5	7	4	7	6	6	5
	5	8	4	6	6	6	6	7	6	6	6
	6	7	8	7	8	6	6	7	6	6	6
	7	5	5	6	6	8	5	5	7	8	6
	5	5	3	5	5	5	7	7	7	8	8
	3	3	8	5	5	8	5	8	5	3	8
	4	4	3	8	7	8	7	7	5	8	7
	3	3	3	4	5	4	7	4	7	7	6
	3	6	3	3	5	3	5	4	4	6	5
	3	3	3	3	3	5	5	3	3	8	5
	3	3	3	4	4	3	5	4	5	7	4

Figure 7. Red = Most sick, orange = "high middle sick," yellow = "low middle sick," and green = least sick. Dark blud = highest priority (score of 8), pale blue = middle priority (score of 5). light grey = least priority (score of 3). Numerical values represent average score of all clinicians who participated in group interviewed. An 8 indicates that all clinicians felt a care item was highest priority for that level of illness, whereas a 3 indicates it is of least priority. SOI: Severity of Illness; LABS: lab draws; MON: Monitors; MV: Mechanical Ventilation; ACC: Venous Access; MEDS: Medications; CRRT: Continuous Renal Replacement Therapy; A&S: Analgesia and Sedation; NUT: Nutrition; SLEEP: Sleep; WC: Wound Care; REHAB: Rehabilitation.

Summary of Findings

1. Multiple measurements demonstrate that mental models of patient condition and treatment priorities are highly variable, and change according to:
    a. patient condition,
    b. institution,
    c. profession or clinician type,
    d. and years of experience.
2. Consistent patterns of information use, descriptive terminology, and treatment preferences exist that could be used to help create explicit models of patient condition and therapeutic appropriateness.
3. These patterns, however, are spread along a condition versus in discrete phases. Therefore, clinician perceptions are often overlapping and, at times, at odds with each if individual clinician perspective is at distant locations on this continuum compared to other clinicians.
4. Tools can be made to support explicit models of these patters that should facilitate clinician communication, better decision making, and consistency of patient care.
5. These findings were presented at regional and national conferences (appendix A) and manuscripts (appendix B) of these findings are currently in draft.

TASK TWO. *Using the information discovered in task 1, create a representation that maps patient progress through the ICU in the form of checklists that identify patients' and care team goals, objectives, and tasks that are commonly associated with a patient's current condition (i.e. "phase of illness").*

Each site has created tools that are similar in function, but differ in design and content (appendix C). These tools are:

1. A patient illness severity assessment tool.

2. A checklist tool that matches treatment options to patient condition.
3. A "TeamView" tool that helps clinicians to visually identify patient condition and care goals.

While each of these tools have similar function, they differ slightly at each of the participating locations. These pragmatic differences stem from the cultures, personalties, other systematic processes, and leadership at each organization. For example, the TeamView at the Dallas site incorporated a diagram of the wounds a patient has, but this does not appear on either the Houston or USAISR TeamViews because these locations have other mechanisms for sharing that information. Both illness severity assessment and checklist tools also vary somewhat in that each participating location. These differences help improve the ecological validity of the model these tools support. Whether or not these differences are clinically important remains to be determined. Ultimately, identifying these differences, categorizing them, and, if possible, identifying "best" options will be a significant contribution of this project to the science of checklist creation and process improvement.

One major difference in the development and implementation of these tools is worth highlighting. Tool development at Dallas site has been challenging for a variety of reasons: change in research team, physical move of the hospital to a new location, etc. Their version of tools are notably different than those at Houston or the USAISR. While the illness severity assessment tool is similar, they have chosen to create discrete checklist for different phases of patient illness (more similar to the original concept of POIP described by Pamplin, et. Al) instead of showing these checklist items along a continuum as was done at the other sites. It will be interesting to compare their tool use and it impact on patient care to that from the other locations.

Also different at the Dallas site was a major challenge from their hospital leadership regarding the acceptability of posting the TeamView outside of patient rooms. While this practice was not an issue at the USAISR or Houston locations. Indeed, The Joint Commission inspection highlighted these tools as a "best practice" for communication while visiting the USAISR location. Nevertheless, the Dallas site is not showing the TeamView in site for the entire team to see. Instead, these are contained in a binder at the patient bedside which must be opened and interacted with. Again, these differences will be noted and described to help identify best practices to facilitate tool use.

Finally, it is worth noting that using these tools changes how clinicians interact and perceive patient care. Observations of this are below (task three) and will be further described as we continue to analyze data. One observation, however, is clear: clinicians find completing and maintains these tools to be time consuming and, at times, tedious. This is a similar finding in other checklist projects. To reduce this burden, we intend to create software that facilitates tool completion if the project is approved for a one year, no cost extension. This software will be digital representation of the paper tools currently used, but will help clinicians through prompts and interface to more rapidly assess necessary updates. Future work could integrate such a tool with electronic medical records to further reduce task burden for the clinician.

Summary of Findings

1. Each site created tools to support the POIP model. Tools have similar functions, however they vary somewhat in form and content. These differences account for the differences in clinical cultures and expectations at each organization and improve the ecological validity of the tools for the work they support.
2. Consistant tool completion, even if valuable to the team, remains challenging at all locations because they are an additional burden to individually overburdened, time pressured, task saturated clincians.

TASK THREE. *Implement the phases of illness paradigm in three Burn Centers and assess its impact on provider understanding of patient status, care priorities, patient outcomes, and effect on communication, teamwork, quality of life, and cognitive workload. Comparative data for providers and patients will be obtained/initiated throughout the project beginning in month 3.*

Numerous delays in implementation at the Houston and Dallas site occurred. Both sites have changed research coordinators during the course of the study. The Dallans site moved into a new hospital in 2015.

Also, the Dallas site has had some difficulty implementing the tools because, despite clinican preferences and empiric data recorded as a part of this project, the Dallas hospital leadership was reluctant to post the TeamView tool outside of patient rooms due to concerns about violating the Health Insurance Portability and Acountablity Act (HIPAA). Leadership at the USAISR and Houston sites did not perceive this to be a problem because no the TeamVIew does not contain any personally identifiable information (PII). Furthermore, the Joint Comission surveyed the USAISR site in 2015 and identified the TeamView tool as a "best practice" for team communications. Despite these arguments, the Dallas site was unable to convince leadership to post the TeamView so that it's information would be available at the patient bedside for all team members, including patient family and friends, to see.

After education of the staff, tools were incorporated into clinical workflow at each of the three participating centers:

- USAISR on May 2014
- Houston on April 2015
- Dallas on November 2015

Clinician perceptions about patient condition were measured using the clinician card sort test and the condition understanding survey (CCST and CUS respectively, see task 1) at the beginning of the study (pre-baseline time point). These perceptions were subsequently measured before implementation of the process improvement (i.e. before tools were introduced in the the clinical environment) and then at six months and one year (at the core site only, data at spoke sites is still being collected). Data for the core site about clinician perception of patient illness severity from the CUS is shown in figure 8 below. Comparisions at one year and from spoke locations at mid point evaluation will be analyzed soon. The core site data demonstrate that discussions about patient condition that occurred through tool development improved clinian agreement about patient condition and that introduction of POIP tools further improved clinician agreement. This suggests that the POIP improves the clinical team's shared mental model of a patient.

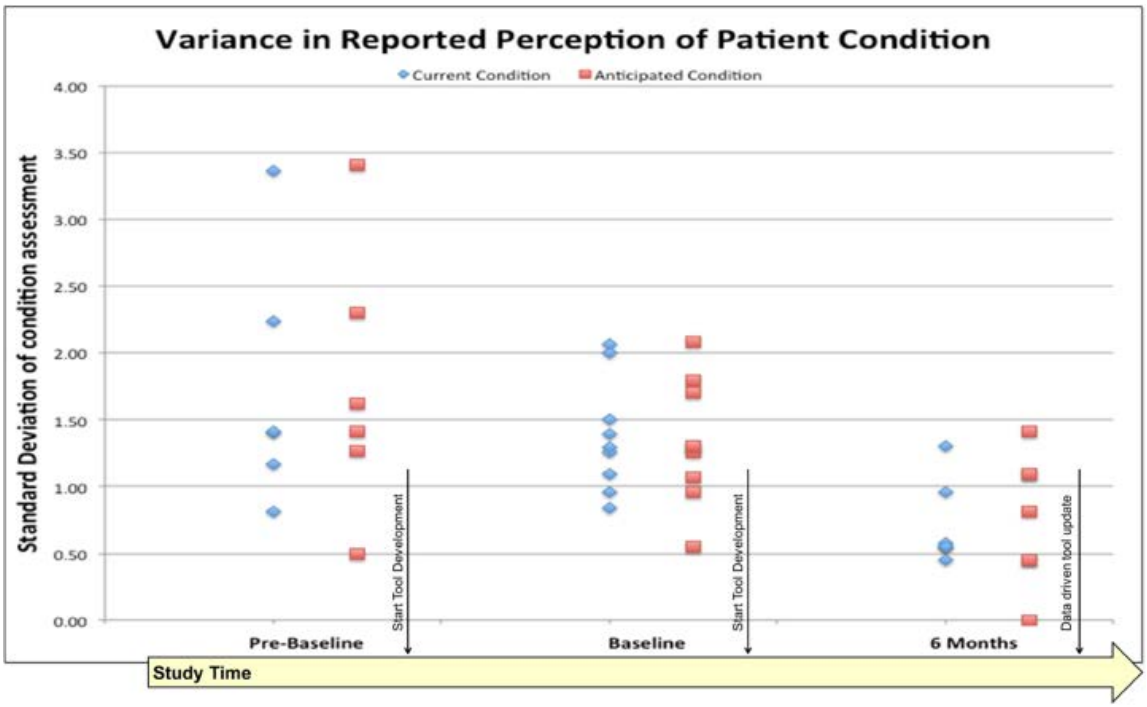


Figure 8. The variance in clinician perception at three time points in from the core study location. Each data point represents the standard deviation of reported severity of illness scores for patients whom at least five surveys were returned. The average varience in these standard deviations was: pre-baseline, ±1.73 and ±1.37; baseline, ±1.38 and ±1.33; six months, ± 0.7 and ±0.76. The decreased variance for both current and anticipated condition was statistically significant at each time point (ANOVA, P = 0.01)

To assess workload perception we used the National aeronautics and space administration task load index (NASA-TLX). We used the TeamSTEPPS perception questionnaire (TPQ) to assess teamwork perceptions among staff. And the POIP User Satisfaction Survey to assess clinician opinions about the POIP tools and model.

NASA-TLX

The pre-basline NASA-TLX is a tool developed to assess cognitive workload across six scales: mental, temporal, performance, effort, frustration and physical. Baseline (pre-implementation) NASA-TLX data from all three sites assessed workload perception differences among clinician types, years of experience, institution and time spent with a patient. We sought to characterize clinician subjective sense of workload when performing two tasks.

1. Identify if the patient is better, same, or worse than yesterday (severity of illness (SOI)).
2. Identify the most important objectives of care for the patient today (priorities of care (POC)).

After multidisciplinary rounds (MDR) on one patient the entire clinical team present was asked to assess their workload perception associated with those two tasks. For statistical analysis, we grouped clinicians into the following groups:

- Student: medical students
- Nurse: all types including registered nurse (RN), licensed practical/vocational nurse (LPN/LVN), clinical nurse specialist (CNS), etc.
- Physician: all attending physicians (burn surgeons, intensivists), fellows and residents.
- Other: all other credentialed providers not represented in any other category.

Summary of Findings

This data and analysis was accepted in manuscript form and is currently in press for the Journal of Burn Care and Research. The Manuscript describes the cognitive work performed by clinicians during MDR in the Burn ICU. The NASA-TLX effectively revealed workload perception differences and similarities in cognitive work associated with completing two critical tasks performed during MDR: identifying a patient's condition (severity of illness, SOI) and prioritizing associated treatments (priority of care, POC). Significant findings include (see PDF of the submitted manuscript for full details in appendix B):

1. Mental demand, temporal demand, performance, and effort were the primary determinants for the cognitive work performed for the identified tasks on MDR with mental demand being greatest;
2. students, nurses, andphysicians all had higher perceived total workload for both SOI and POC than "others";
3. students perceived the most effort on rounds and had the most mental demand when identifying POC and significantly more than "others" when identifying SOI;
4. students, nurses, and physicians experienced significantly more temporal demand when identifying POC than did "other" healthcare providers while only nurses and physicians perceived this significantly more than others for identifying SOI;
5. clinicians with the least experience had higher perceived workload when identifying SOI and POC as compared to those with more experience;
6. and some individuals perceived more frustration and physical demand than most others during MDR.

We will analyzine the change in clinician cognitive work for these two tasks over time using this same tool at six months and study endpoint at each participating location.

TeamSTEPPS

The TeamSTEPPS-Teamworwk Perceptions Questionnaire (T-TPQ) was completed at all three sites to establish baseline teamwork perceptions among clinicians. This tool was specifically designed for health care and has been validated across many different types of clinical settings.

Summary of Findings

The pre-baseline T-TPQ data has been collected at all three sites. We collected 129 surveys (physician: 19, nurse: 87, other: 23). There were no significant differences among clinician groups (nurse, physician, other). There was a high degree of acceptable perception of teamwork with a majority of staff (89-100%) across all sites having mean scores greater than 3 for all subscales. We also established good to excellent internal consistency and reliability for all scales (Cronbach's alpha: .85-92).

These results suggest that teamwork in the BICU is perceived as being better than many other ICU environments and that determining the underlying reason for better perceptions of teamwork in the BICU could be used to improve teamwork in other ICU settings.

This data was presented in abstract form (see appendix A) and a manuscript is in draft. We will analyzine the change in clinician perception of teamwork over time using this same tool at six months and study endpoint at each participating location.

USER SATISFACTION

The User Satisfaction Survey is a ten-question survey. Each question assesses clinician perspectives about the POIP as a whole (the tools and overall model taken together) using a five point Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree). For purposes of analysis, we grouped reponses into disagree (1 or 2), agree (4 or 5), and neutral (3).

Six-month data was preliminarily analyzed for the core site only and will be presented at the American Burn Association Annual Conference this May. We surveyed 48 end-users: 3 Physicians, 30 Nurses, and 15 other healthcare providers (respiratory therapists, rehabilitation specialist, dietitians, pharmacist, etc.). Mean scores are shown below in figure 9. Overall satisfaction was rated above neutral (3.23 ± 0.98). Physicians were more satisfied than nurses: 100% Satisfaction (n =3) vs. 36% dissatisfaction (n=30).

Figure 9. Mean scores for clinician perception of the Phases of Illness Paradigm and the tools used to introduce this model of patient care to one Burn ICU.

Summary of Findings

1. The POIP checklist tools supported teamwork and communication without interfering with workflow for most participants
2. After 6 months of use, most clinicians were comfortable with the tools yet daily use was lower than expected
3. We used this and other data to update tools (see below) to improve use and, hopefully, user satisfaction.
4. We will analyze the change in clinician perception of the POIP and its tools over time using this same survey at the other participating sites and at all sited at study endpoint.

We are currently developing a retrospective protocol that will assess the impact of these interventions on clinician performance (i.e. adherence to the suggested practice patterns outlined by the POIP tools) and on patient outcomes. This retrospective protocol will be submitted for IRB and HRPO review in the next quarter.

TASK FOUR. *Review and update the Phases of Illness Paradigm (POIP) checklists and assess the time it takes for new checklist items to be reliably completed without new/additional education for the healthcare team.*

The core site updated their tools from March to July 2015. The new tools and workflow were introduced in July 2015 (appendix C). Key finding and changes included:

1. The tools when used, were valuable for team situational awareness, but when not completed consistently led to dissatisfaction with their outputs and little impact on patient care. Users requested to incorporate the tools key features (illness severity assessment and corresponding checklists of care priorities) into their daily workflow. This was accomplished by developing both nurse and physician report tools. Nurses could use these tools during change of shift report and residents could use these tools when reporting for multidisciplinary rounds.

2. The TeamView was perceived to have the most potential benefit for team communication, but it was underutilized. The most important feedback was that the tool was not referenced or reviewed during

multidisciplinary rounds. When it was, the tool was perceived as providing value. This lead to a decision that resident physicians and physician assistants would be responsible for updating the TeamView (vice nurses) and emphasis on using the tool during rounds.

3. Team View was modified so that it did not duplicate information found in other areas of the team's workflow. Specifically, the daily checklist items were removed from the TeamView, as these were already available in multiple other locations (the EMR note, the "charge nurse checklist" and the resident handoff tool). Additional areas were added to leave messages, identify patient allergies and code status, and to prioritize/synchronize commonly conflicting care tasks (i.e. procedures vs. wound care vs. rehabilitation vs. imaging).

4. A separate TeamView tool was created for patients on extracorporeal membrane oxygenation (ECMO)

Assessment of the impact of these changes is currently ongoing at the core site for final data collection. Anecdotal observations following the tool updates are: 1. The TeamView tool is updated consistently and is valued by team members for maintain the "whole picture" of a patient. Family members interact with the tool to get a daily update on patient condition. 2. Scales and checklist tool use remain inconsistent. Nursing staff do not use them. Physician staff, primarily residents and medical students, find the tools valuable to get a "gist" of patient progress through the BICU, important care elements, and how to apply these care elements.

The Houston site implemented their tools in March 2015, but due to low patient volume and a change in their site's research nurse, their mid-point assessment and tool update is currently on going (April 2016). The Dallas site implemented their tools in November 2015. They changed research nurses associated with this project between March and April 2016 and will start mid-point assessment and tool updates as soon as possible.

Assessment of tool impact on patient outcome and clinician reliability will be evaluated through retrospective review of electronic medical record data. This protocol is currently being written.

D. Key Research Accomplishments

- Models of clinician perceptions of patient condition and progress through the Burn ICU are described at all three sites.
- Tools that aid clinical assessment of patient illness severity and that help identify important treatment priorities are implemented at 3 sites.
- Differences in hospital and unit level leadership, and unit culture *directly* impact the success of process improvement. Differences in these important system features at each location have led to variability in how tools are implemented, valued, and utilized.
- There are differences in how clinicians think demonstrated by the mental models elicited from the card sort data, the condition understanding data, and through individual and group interviews. There are differences among professions or clinician types, by years of experience, and among institutions. These differences are important to acknowledge as they impact communication, care coordination, and ultimately patient safety and outcomes.
- The process of studying clinician perceptions about patient condition and implementing a model of care that highlights patient condition and care priorities makes clinician perception about patient condition more consistent.
- There are differences among professions or clinician types in workload perception, with statistical significance between:

    o Students and others for mental and overall effort.
    o Physicians and others for overall workload.
    o Nurses and others for overall workload.
    o Physicians and others for temporal demand.
    o Nurses and others for temporal demand.

- Mental, temporal, performance and effort all contribute significantly more to the overall cognitive workload than physical or frustration subscales.
- Teamwork perception at all three sites was perceived as highly favorable.
- The T-TPQ is a valid and reliable tool to measure teamwork perception in the burn ICU.

E. Conclusions

The Phases of Illness Paradigm in a valid model for patient progress and care prioritization in the Burn ICU. Differences in clinical perception of patient condition and care priorities impacts patient treatment. When clinicians have different mental models of a patient, care may be fractured, priorities may be different, and friction occurs between clinicians. When clinicians share the same mental model of a patient, care is consistent, synchronized, and clinicians will likely perform better as a team.

Process, workflow, and leadership all play an important role in implementing systematic changes in how clinicians perform work. Even when processes may improve patient care, if they do not match clinician workflow or leadership does not prioritize them, there is marginal adoption of the process, little change in culture, and limited impact on patient care. When process matches workflow and leadership supports change, then tools like the POIP model can impact and change unit culture.

Final data collection and analysis is ongoing for this project at the core site.

F. Publications, Abstracts, And Presentations

Manuscripts

1. McInnis I, Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. “Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs.” Journal of Burn Care & Research [In Press]

Presented Abstracts

1. Pamplin J, Murray S, Serio-Melvin M, Aden J, Huzar T, Wolf S, Chung K, Nemeth C. “Variations on a theme: How clinician descriptions of patient condition diverge.” Presented at the Society of Critical Care Medicine Annual Congress, 21-24 February 2016, Orlando, FL.
2. Murray S, Pamplin J, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S. “Using Focus Group Interviews to Validate Team Communication Tools in the Intensive Care Unit.” Presented at the Society of Critical Care Medicine Annual Congress, 21-24 February 2016, Orlando, FL.
3. Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. “Developing Cognitive Tools for the Intensive Care Unit: A Mixed Methods Approach.” Presented at the Tri-Service Nursing Research Program Annual Conference, 2015, Bethesda, MD.
4. Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. “Revealing the different perceptions burn ICU clinicians have regarding patient illness severity and clinical treatments using card sort methodology.” Presented at the Tri-Service Nursing Research Program Annual Conference, 2015, Bethesda, MD.
5. Murray S, Chung K, Mann-Salinas E, Serio-Melvin M, Huzar T, Wolf S, Nemeth C, Pamplin J. “Developing Cognitive Aids According to the Phases of Illness Paradigm for use in the Burn ICU.” Presented at the Military Health Research Symposium, 17-2701 August 2015, Ft. Lauderdale, FL.
6. Brown T, Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. “Perceptions of Teamwork in the Burn ICU.” Presented at the Military Health Research Symposium, 17-2701 August 2015, Ft. Lauderdale, FL.
7. McInnis I, Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. “Comparing the Workload Perceptions of Determining Patient Condition and Priorities of

Care Among Burn Providers in Three Burn ICUs." Presented at the Military Health Research Symposium, 17-2701 August 2015, Ft. Lauderdale, FL.

8. Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. "Comparing the workload perceptions of determining patient condition and priorities of care between burn providers in three burn ICUs." Presented at the American Burn Association Annual Meeting, Chicago, IL April 2015
9. Pamplin J, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C. "Discovering mental models that burn ICU clinicians' use for decision making using card sorts." Presented at the American Burn Association Annual Meeting, Chicago, IL April 2015

Accepted Abstracts for Presentation

4. Leazer S, Murray S, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Huzar T, Wolf S, Nemeth C, Pamplin J. "Understanding Clinician Perspectives of Patient Condition and Care Goals in the Burn Intensive Care Unit." Accepted for presentation at the American Burn Association, Las Vegas, NE, 4-7 May 2016
5. Pamplin J, Murray S, Serio-Melvin M, Aden J, Huzar T, Wolf S, Chung K, Mann-Salinas E. "Getting the Burn Team to play from the same playbook: Understanding clinician perception of patient condition." Accepted for presentation at the American Burn Association, Las Vegas, NE, 4-7 May 2016
6. Murray S, Phillips S, Rodriguez J, Serio-Melvin M, Aden J, Mann-Salinas E, Chung K, Nemeth C, Pamplin J. "Achieving Ecological Validity: Creating Decision Support Tools for the Burn Intensive Care Unit." Accepted for presentation at the American Burn Association, Las Vegas, NE, 4-7 May 2016

G. Inventions, Patents And Licenses

Not applicable.

H. Reportable Outcomes

1. The core site has described how clinicians perceive patient condition and progress through the ICU. These perspectives have been organized into a "scales tool" and a "bedside checklist tool." The final implemented tools and the Core Site in-service are included in appendices B & D and appendix J, respectively. These tools and their development were presented in abstract form at the Military Health System Research Symposium, Ft. Lauderdale, FL, 18-21 August 2014 (previously submitted) and were presented nationally at the Society of Critical Care Medicine Annual Congress, 17-21 January 2014, Phoenix, AZ.
2. Using data collected from the Core and Houston Sites, the project has identified significant differences in the mental models that clinicians use to prioritize information related to patient condition and treatments. Physicians, nurses, physician trainees, respiratory therapists, nutritionists, and clinicians of different experience levels prioritize information and treatment options differently. These results have been presented at the American Burn Association Annual Conference, 21-24 April 2015, Chicago, IL (previously submitted).
3. We have also analyzed the NASA-TLX data from all three participating sites and have described the cognitive workload that clinicians perceive while performing the tasks of identifying patient condition and treatment priorities during multidisciplinary rounds. Clinicians of different experience levels and of different professional backgrounds perceive their workload differently. Decreasing this workload may free cognitive processes to focus on more important decisions. These results were presented to the American Burn Association Annual Conference, 21-24 April 2015, Chicago, IL (previously submitted). In addition, a manuscript on this topic is in press for publication in the Journal of Burn Care and Research (previously submitted).

4. These mental models have been used at the Core and Houston sites have validated the “scales” and “checklist” (now called “TeamView”) tools through focus group interviews. The tools have been produced for use at the core site and have undergone unit level review at all three sites, and pilot testing at 2 sites (previously submitted).
5. We have analyzed the first round of TeamStepps data from all three sites and found that there were no significant differences among the clinician groups, sites, or for experience levels. There was a high degree of acceptable perception of teamwork. The majority of staff (89-100%) across all sites had mean scores greater than 3 for all subscales. We found that the TeamStepps perception questionnaire had good to excellent internal consistency and reliability for all scales (Cronbach’s alpha= .85-, .92). A manuscript explaining this data is in progress.
6. We have analyzed the CUS data, pre-baseline round 1 from the core site, quantifying the text data (thematic analysis). The CUS tool asked all clinicians caring for the same patient to identify how sick their patient was (0-10 scale) and note the goals, objectives, and tasks for the current day and the next day. We identified 169 responses from 60 participants that met the definition of “goal.” We were able to identify that clinical teams have difficulty perceiving common goals for patients, often misidentifying objectives as goals. There was very little goal agreement between clinicians caring for the same patient. (previously submitted).
7. We also analyzed the variance in severity of illness scores (SOIs) on the first 3 rounds (pre-baseline, baseline, and at 6 months of tool use) at the Core site. We found a significant decrease in variance over the study period (ANOVA, p=0.01). (previously submitted).
8. We analyzed the user satisfaction surveys at the core site and found that users (n=46; Physicians: 3; Nurses: 30; Other: 13) were in agreement that the tools supported teamwork and communication without interfering with workflow. After 6 months of use, most clinicians were comfortable with the tools. The POIP checklist tools are ecologically valid and support the work domain of the burn ICU clinicians.
9. We analyzed the focus group interviews at the core site (n=28 participants, 6 groups) finding that clinicians identified SOI according to their perception of patient overall condition and current trajectory. Temporal and historical factors play important parts in not only determining how clinicians think about their patients but also how they prioritize care. Understanding team perception may improve communication and patient safety.
10. We analyzed the card sort surveys and found that the language that ICU clinicians use to describe patients poorly differentiates them according to SOI. Of the 169 clinicians and 77 unique patients (Staff Physician: 25; Nurse: 61; Resident: 40; Others: 43), on average staff physicians chose 5±2 descriptors, nurses and residents chose 4±2 descriptors, and clinicians in other roles chose 6±2 descriptors. Eight percent added novel terms, and only one term was consistent with a specific category (“ready for transfer” with least sick).
11. Using thematic coding we analyzed the baseline Condition Understanding Surveys (CUS) responses identified as “goals” (n= 60 clinicians, 169 responses) finding 95 (57%) met the definition of a goal. Among the coded goals, the top 3 were: Adequate perfusion/Monitor Perfusion (19%), Ventilator Liberation (12%) and Infection Treated/Cured (12%). Top goals varied according to patient condition: for Least Sick patients, the top coded goal was to "Transfer to Ward" (29%); for Middle Sick patients, they were "Ventilator Liberation" and to "Improve Function/Rehabilitation Tolerance" (10% each); and for Most Sick patients, it was "Adequate Perfusion/Monitor Perfusion" (28%). Overall goal agreement between team members was 28% +/- 17%. Overall, we found that clinicians had difficulty identifying common goals for patient care and often misidentify objectives and tasks as goals. There was very little agreement in goals between team members.

I. Other Achievements

Nothing to report.

J. Future plans and funding options.

Because of delays in implementation and data collection at all research sites, but primarily at the Houston and Dallas sites, the PI has requested a one year no cost extension (NCE) to complete work. The Houston Site is in the process of updating tools and workflow. The Dallas site will do so shortly with a new research coordinator. We will complete final data collection and analysis after sites complete at least three months of tool use.

A retrospective protocol that assess the POIP's impact on patient outcome and clinician reliability is being written. This protocol will review electronic medical record data and compare patient condition identified electronically to POIP conditional assessments, evaluate variance in patient therapies that are recommended by the POIP checklists, consistency of POIP tool completion, and overall patient outcomes.

The core site has nearly completed final data collection. As this occurs, this site will start to implement new clinical practice guidelines that incorporate patient illness severity assessment and targets management strategies accordingly for mechanical ventilation and for pain, agitation, delirium, and sedation.

Because of savings in research coordinator costs at the core site, we are able to fund a software engineer to create a digital version of the POIP tools (illness severity assessment tool, corresponding checklists, and the TeamView) if the NCE is approved. We anticipate that this type of technology can help facilitate POIP implementation and enhance workflow, primarily by reducing clinician time.

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Discovering mental models that burn ICU clinicians use for decision making using card sorts.

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Disclosures

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

This study was conducted in accordance with protocols reviewed and approved by Institutional Review Boards at the Brooke Army Medical Center, Memorial Herman Hospital Texas Medical Center, and the University of Texas, Southwestern Medical Center.

I have no financial disclosures.

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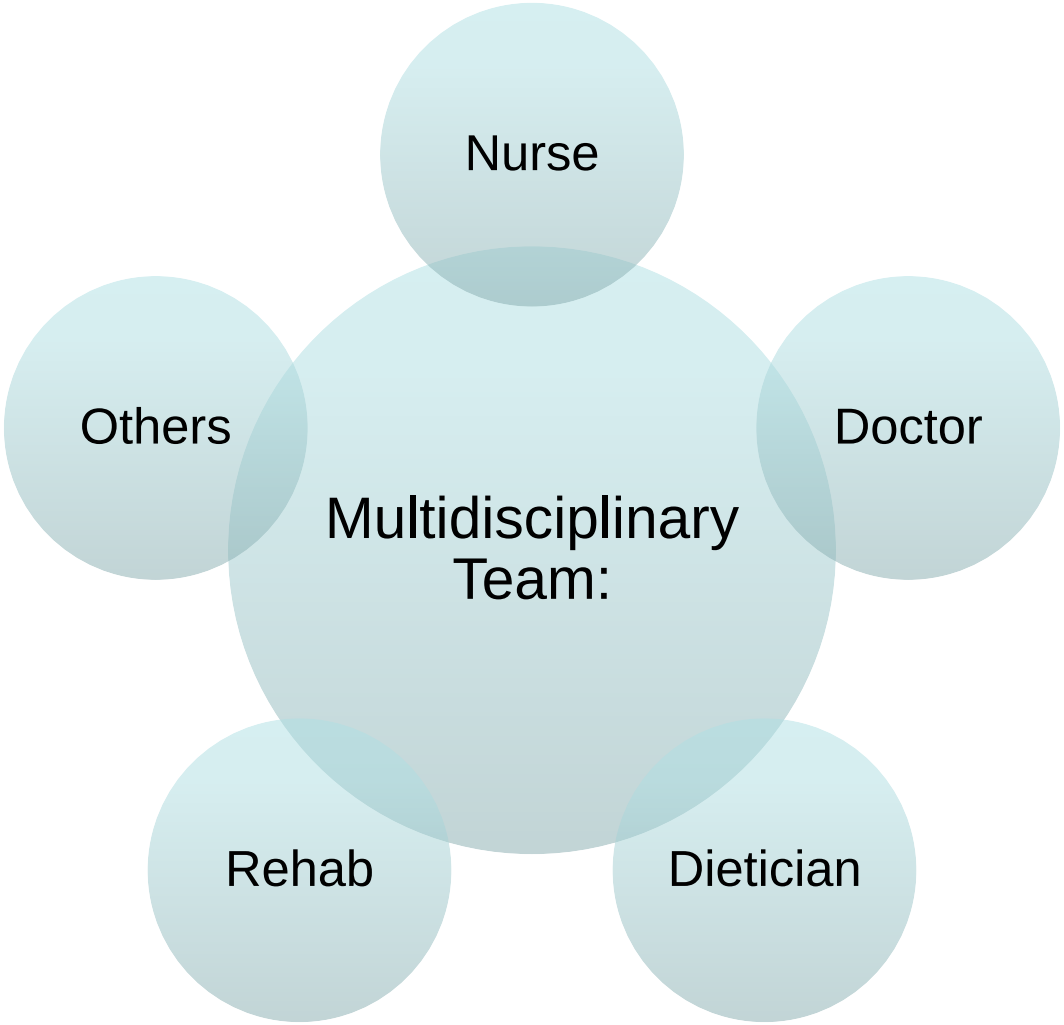
Introduction



Consider this…

- Have you ever experienced the following:
  - Although a plan of care was established, the entire team was not on the same sheet of music?
  - You had a “gut” feeling that your patient was “sicker” (or “less sick”) compared to how the rest of the team was treating him/her but you couldn’t quite explain it?
    - And you certainly could not explain your “feeling” to other team members?
  - That there was a disconnect between how aggressive (or too cautious) the team was being with respect to a plan of care compared to your own “instinct” of what should be done?

Hypothesis

- **Hypothesis**:
  - A novel research method may uncover different mental models that team members have regarding patient illness severity and clinical treatments.

Q Methodology: Card Sorting

- Q Methodology: Developed by psychologist: Dr. William Stephenson (1935)
  - Framework to study subjectivity
  - Quantitative method to evaluate subjective data

- Used in
  - Information Architecture and web design:
    used to understand an end-user's point of view
  - Nursing, Veterinary, Medicine, Public Health, Transportation, Education, etc.

Using QMethodology to Identify Reasons for Distress in Burn Survivors Postdischarge

Shelley Wiechman Askay, PhD,* Michael Stricklin, PhD,†
Gretchen J. Carrougher, RN, MSN,‡ David R. Patterson, PhD,*
Matthew B. Klein, MD, FACS,‡ Peter C. Esselman, MD,*
Loren H. Engrav, MD, FACS‡

Card Sorting

- We developed a card sort based on interviews with burn critical care experts (a burn surgeon, intensivist, and nursing staff).
- The final card set included 97 cards:
  - 67 cards in 10 categories of “features” used to judge patient illness severity
  - 30 cards in 9 categories “treatments,” for a total of : 67 features and 30 treatments.

- Card Sort Technique:
- Participants are asked to think about their patient and determine on a scale of 1-10, how sick their patient is
  - 1 = Least Sick, “could transfer today”
  - 10 = Most Sick, “could die today”
- Step 1:
  - Select all the cards that represent features that you consider important to how sick your patient is
  - Cards are then organized in grid
- Step 2:
  - Select all the cards that represent the treatments you think this patient should have
  - Cards are then organized in grid

Methods

- Part of a prospective, mixed methods study of clinical decision making and how to create tools that support it
- 3 academic, regional referral burn ICUs.
- Approved by the institutional review board at each site.

Card Sorting

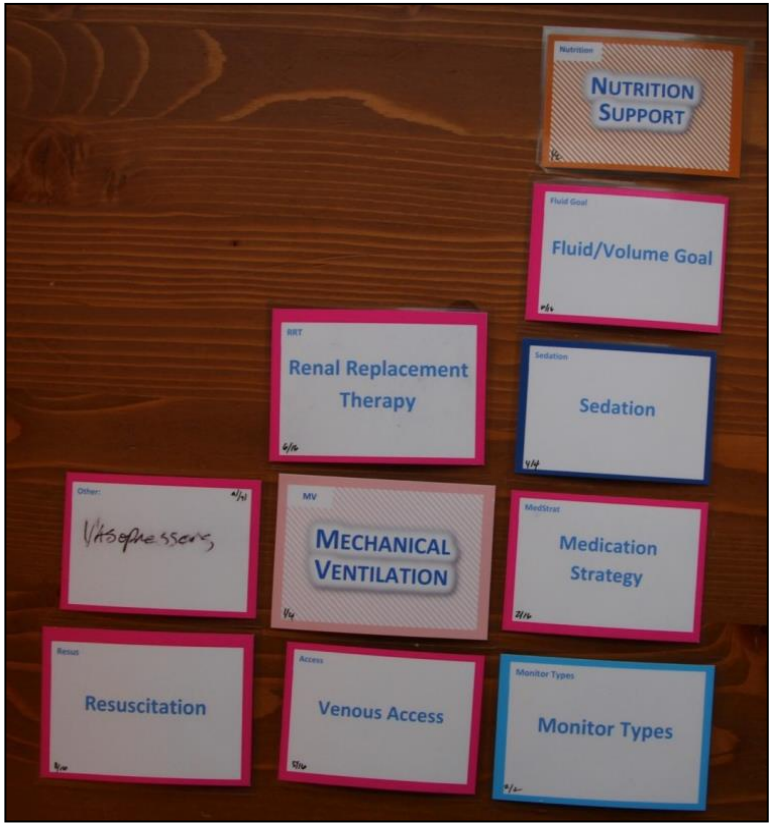
Example Feature Card Sorts

Sickest Patient/Could Die today (SOI 10)

Least Sick Patient/Could Transfer (SOI 1)

Example Treatment Card Sorts

Sickest Patient/Could Die today (SOI 10)



Least Sick Patient/Could Transfer (SOI 1)

Results

- **169** card sorts, **77** patients
- Average time: **35.5** ± 15.8 min [10-100 min]
- Average # Feature Cards: **9** ± 2 cards [3-16]
- Average # Treatment Cards: **8** ± 2 cards [3-14]

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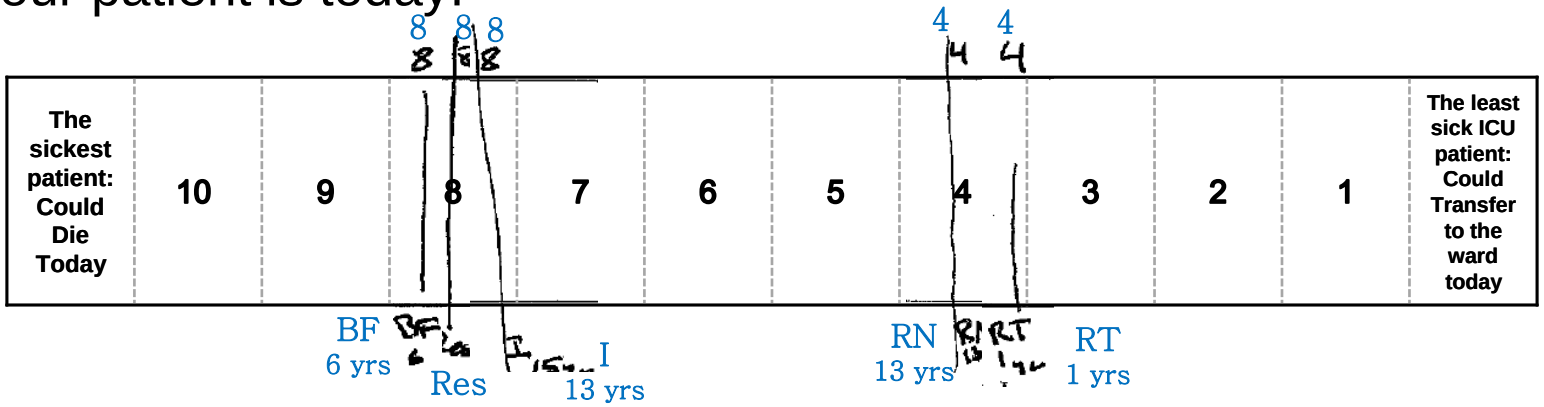
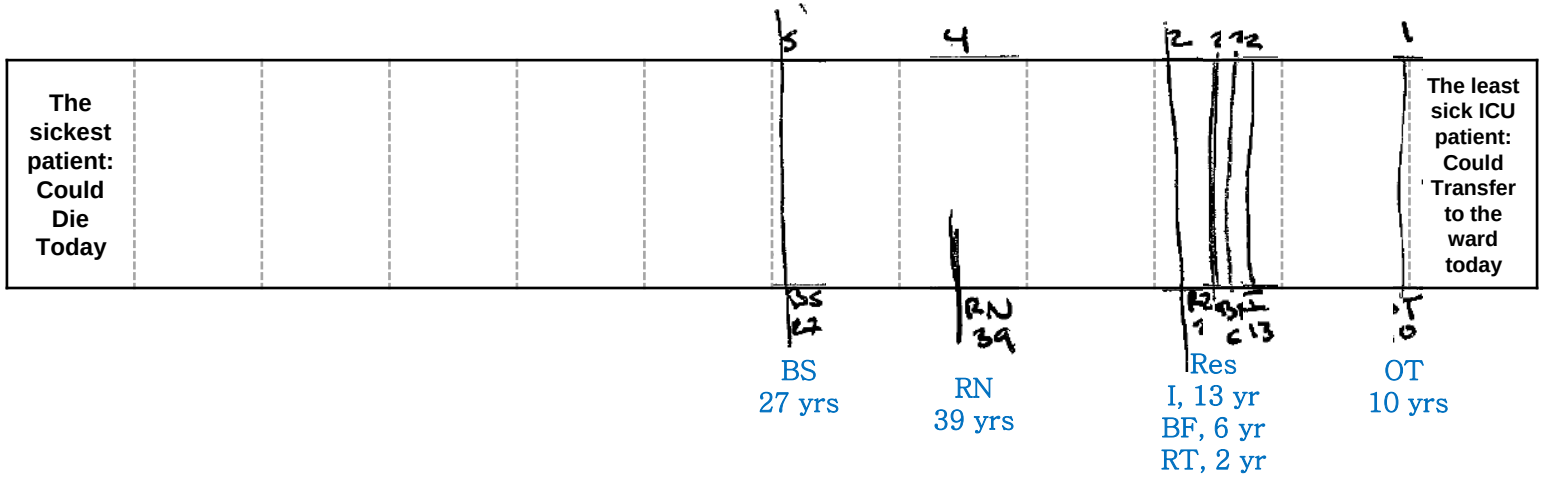
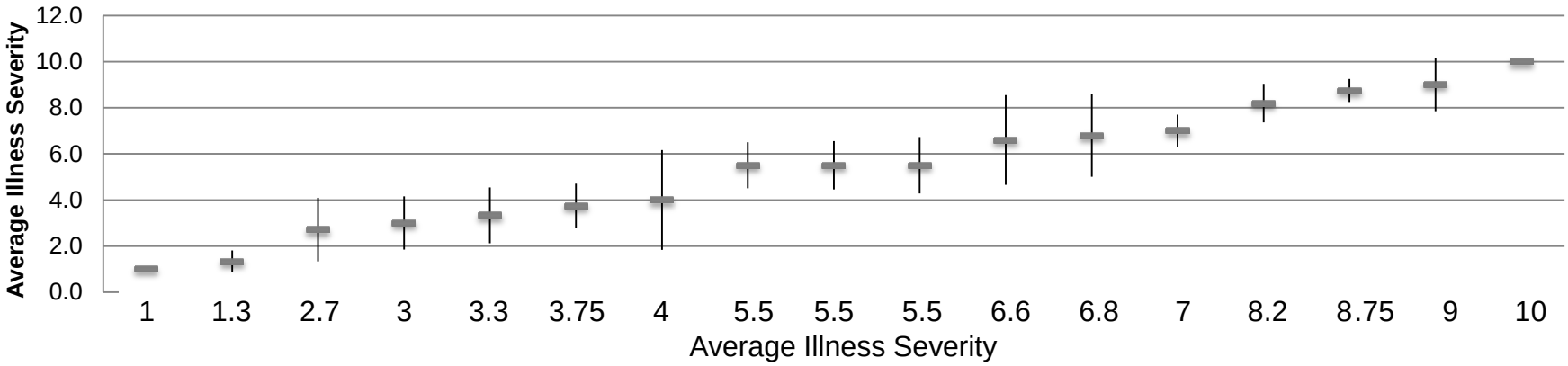
Clinician Perception

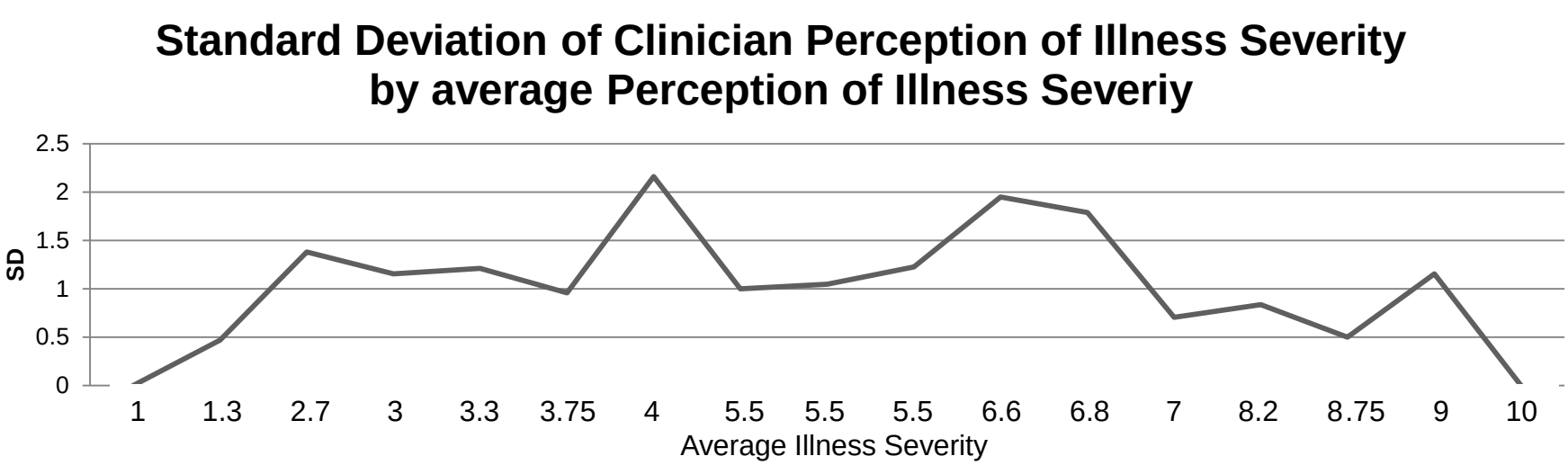
- In the diagram below, please use a vertical line to indicate “where” your patient is today:





Perception of Illness Severity





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Word Clouds

Attending Physicians
25 Sorts, 23 Patients

Nurses
61Card Sorts, 56 Patients

Word Clouds

Attending Physicians
25 Sorts, 23 Patients

Physician Trainees
40 Sorts, 41 Patients

Limitations

***"All models are wrong, but some are useful."* – G. Box**

- Subjects review cards created by the research staff during interviews with a small number of clinicians.
  - The mental models may be anchored by the card set available
  - Example: a clinician considered pulse pressure variability as an indicator of volume status but since that card was not specifically available, the subject choses
    - to pick a card that represented the same concept (e.g. Monitoring: CVP)
    - to opt for a different card/concept altogether or
- Did not investigate the intra-rater reliability

Conclusions

- Burn ICU clinicians have different perceptions about
  - patient condition
  - treatment priorities
- The card sort method successfully elicits mental models from clinicians during routine daily activity
  - These models vary according to patient illness severity, clinician type, clinician experience, and institution

Conclusions

- These differences likely impact effective communication:

What happens when the nurse communicates a different message than the attending to the family?

- Better understanding and awareness of these differences in mental models may improve teamwork.

- Will aid the development of decision support tools.

Thanks to all of the clinicians who took part in the card sorts.

Questions?

Comparing the Workload Perceptions of Determining Patient Condition and Priorities of Care Between Burn Providers in Three Burn ICUs

Sarah J. Murray, PhD (c), MSN, RN[1]; Maria Serio-Melvin, MSN, RN[1]; James K. Aden, PhD[1]; Elizabeth A. Mann-Salinas, PhD, RN, FCCM[1]; Kevin K. Chung, MD, FCCM, FACP[1]
Todd Huzar, MD, FACS[2]; Steven Wolf, MD, FACS[3] ; Christopher Nemeth, PhD[4]; Jeremy C. Pamplin, MD, FCCM, FACP[1]

1. United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX; 2. Memorial Hermann Hospital, Texas Medical Center, Houston TX; 3. University of Texas, Southwestern Medical Center, Dallas, TX; 4. Applied Research Associates, Inc., Fairborn, OH

Introduction

- Burn critical care is complex and error prone due to high cognitive workload associated with information overload and miscommunication.
- Multidisciplinary Rounds (MDR) in the Burn Intensive Care Unit (BICU) are the mechanism for reviewing patient status and planning care in the burn intensive care unit (BICU).
- The cognitive work associated with MDR is often unrecognized.
- The National Aeronautics and Space Administration Task Load Index (NASA-TLX) assesses workload on 6 scales: Mental, Temporal, Performance, Effort, Frustration, & Physical.

Objectives

- We sought to characterize clinician subjective sense of cognitive workload while completing 2 tasks:

  Task 1: Identify[ing] if the patient is better, same or worse than yesterday (Severity of Illness); and

  Task 2: Identify[ing] the most important objectives of care for the patient today.

Methods

- After consents were obtained, research staff at 3 regional referral centers administered the NASA-TLX to the multidisciplinary team:
- Immediately after MDR on a single patient
- Using paper or electronic formats (tablet)
- At different points in time; early, middle or late in the MDR activity
- A total of 5 patient MDR's were assessed at each site
- Directions were read aloud to the entire team
- The MDR groups were defined as:
  - Student: medical students
  - Nurse: all types including RN, LVN, and master's prepared (Clinical Nurse Specialist, MSN)
  - Physician: all attending physicians (burn surgeons, intensivists), fellows and residents
  - Other: All credentialed clinicians not represented in any other category
- Statistics: One-way ANOVA

Results

- The data represent 116 clinicians, 5 patient MDRs, across 3 sites including 14 staff physicians, 25 nurses, 18 residents, 37 in other roles, and 13 students.
- The sample reported moderate difficulty (weighted cognitive load= 42) for both tasks.
- Mental, temporal, performance, and effort all contributed significantly more to the overall cognitive load than physical or frustration subscales.

Task 1: Identify if the patient is better, same or worse than yesterday

Table 1: Cognitive Workload by Profession

★Significant Comparisons:
All comparisons: $p < 0.05$

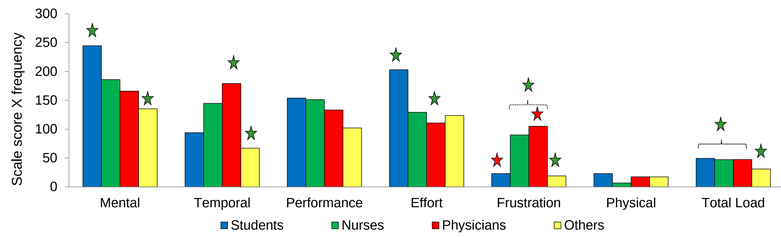
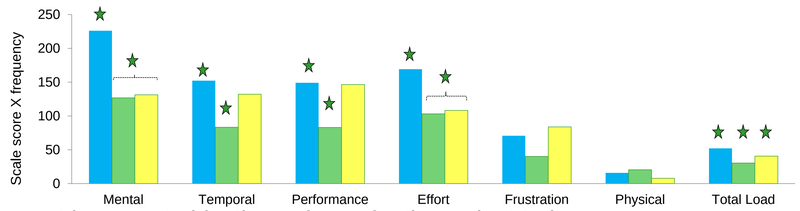


Table 2: Cognitive Workload by Years of Experience

Significant Comparisons:
- A, B, G, H = $p < 0.0001$
- C, D = $p < 0.05$
- E, F = $p < 0.005$



Task 2: Identify the most important objectives of care for the patient today

Table 3: Cognitive Workload by Profession

Significant Comparisons:
- A = $p < 0.05$
- B, C= $p<0.005$
- D $p=0.0006$
- E, F, G = $p<0.0001$

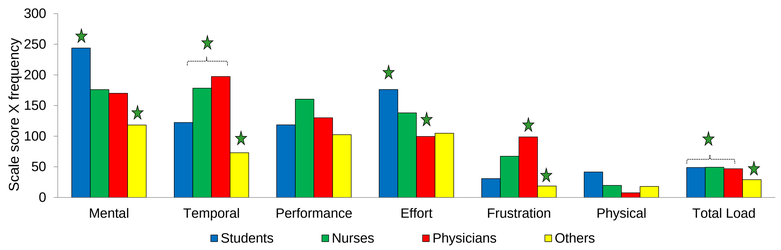
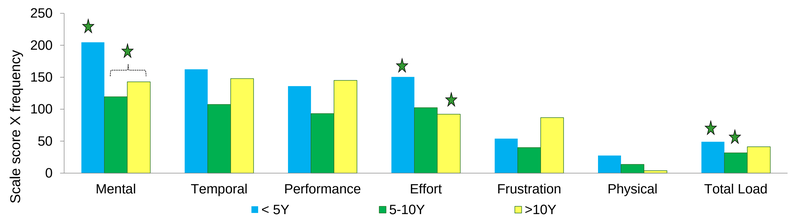


Table 4: Cognitive Workload by Profession

Significant Comparisons:
- A, B, C, G, H, I = $p<0.005$
- D, E = $p< 0.05$



Discussion

Key Findings:

- Mental demand, temporal demand, performance, and effort were the primary determinants in equal proportions for the cognitive work performed for the identified tasks on MDR.
- Providers with less experience have higher perceived workload when identifying SOI and POC as compared to those with more experience.
- Students exert more mental work and overall effort to identify SOI and POC than all others.
- Non-physician, non-nurse providers as a group perceive less workload identifying SOI and POC than do physicians and nurses.
- Physicians and nurses experience significantly more temporal demand completing these tasks than do non-physician/nurses.

Conclusions

- The work of identifying patient condition and treatment priorities varies according to clinician type and experience level, but not by institution or the time spent caring for a patient.
- Identifying patient condition and treatment priorities may affect workflow, decision-making, communication, and teamwork.
- Understanding how various clinical roles perceive cognitive workload differently could lead to work process improvements and IT support for better clinician and team performance.
- The NASA-TLX is useful in assessing workload perception in the BICU.

Acknowledgements

We would like to thank:

Nicole W. Caldwell, RN Research Coordinator at the USAISR for her unparalleled regulatory support and guidance;
Agnes Burris, RN, Senior Research Nurse, and Christopher Tran, MBA at UT Southwestern Medical Center; & Adrian Botello, CSTR Trauma and Burn Research Coordinator at Memorial Hermann Hospital; for their hard work and dedication to this project.

This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011).

#169

Developing Cognitive Aids According to the Phases of Illness Paradigm for use in the Burn ICU

Sarah J. Murray, MSN[1]; Kevin Chung, MD, FCCM[1]; Elizabeth Mann-Salinas, PhD, FCCM[1]; Maria Serio-Melvin, MSN[1]; Todd Huzar, MD[2]; Steven Wolf, MD, FACS[3]; Christopher Nemeth, PhD[4]; Jeremy Pamplin, MD, FACP[1]

1. US Army Institute of Surgical Research, JBSA FSH, TX; 2. Memorial Hermann Hospital Texas Medical Center, Houston, TX; 3. Parkland Health and Hospital System, Dallas, TX; 4. Applied Research Associates, Inc., San Antonio, TX

Introduction

- Teams of individuals from different professional backgrounds, provide complex care for patients in Burn Intensive Care Units (BICUs)
  - Team care is challenged by communication lapses borne from differences.
  - Professional silos may produce discordant care.
- Well designed, ecologically valid cognitive aids help clinicians make decisions more efficiently, reliably, and accurately and may improve patient care.
  - Checklists, clinical pathways, order-sets, protocols, and guidelines are examples of cognitive aids that improve outcomes in healthcare.
- The Phases of Illness Paradigm (POIP) is a theoretical framework that intends to describe patients with similar severities of illness for which clinicians may define expected goals, objectives, and tasks of care.
- This research was designed to
  - Validate the POIP framework as shared mental model
  - Develop ecologically valid cognitive aids to support the POIP

Objectives

Primary

•To understand the BICU work domain in terms of patient condition, patient progress, and clinician behaviors in order to create ecologically valid cognitive aids.

•To improve the multidisciplinary Burn ICU team's understanding of patient condition, daily care priorities, and anticipated care goals.

•To validate the POIP as a shared mental model.

Secondary

•To further develop the POIP by investigating clinical behaviors in the environment it is meant to support.

Exploratory

•To determine if a shared mental model will improve clinician perception of communication, teamwork, work satisfaction, and cognitive workload in the burn ICU.

Discussion

- BICU clinicians think about patients in different ways.
- Shared mental models may improve team understanding of patient condition and care priorities.
- Although patient condition is a continuum, clinicians perceive certain types of care more discretely along that continuum and may anticipate priorities of care accordingly.
- Tools may improve recognition of discordant care and may expose differences of perspectives which may foster improved communication.

Key Points

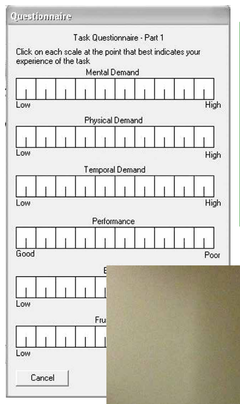
- The described research will develop ecologically valid cognitive aids to support clinical decision making in the BICU.
- We anticipate that the POIP will:
  - decrease cognitive load
  - improve communication
  - make care more reliable

Methodology

This Institutional Review Board approved protocol includes mixed methods, participatory research project broken down into four main tasks:

Task 1: Describe a Patient's progress through the BICU

- Condition Understanding Survey
- NASA-TLX Survey
- TeamSTEPPS Survey
- Clinician Card Sort: Q Methodology
- Group Interview

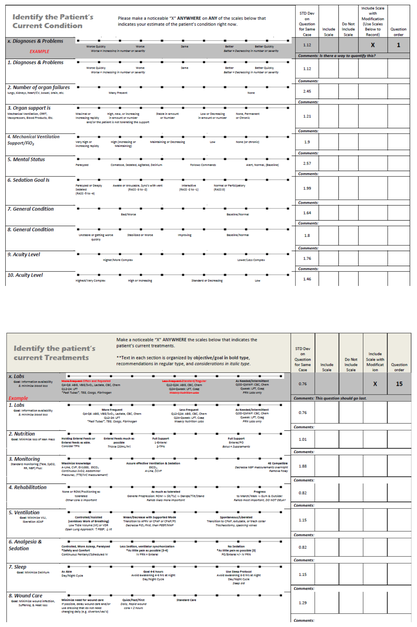


Condition Understanding Survey:

- How sick is your patient today?
- What are the top 3 Goals, Objectives, and Tasks today?
- How sick will your patient be tomorrow?
- What are the top 3 Goals, Objectives, and Tasks for tomorrow?

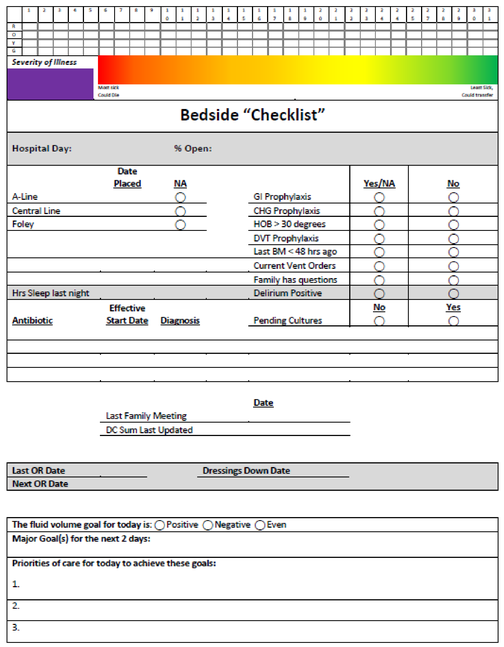
Task 2: Develop Representations of Patient Progress

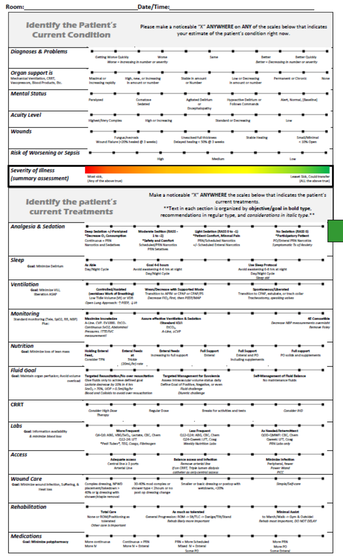
- Delphi Consensus Building
  - The elements from the card sorts and group interviews were correlated with severity of illness scores on the scales.
  - 80% consensus was achieved on each of the elements for the final version.
- Group Interview



Task 3: Implement the POIP in the BICU

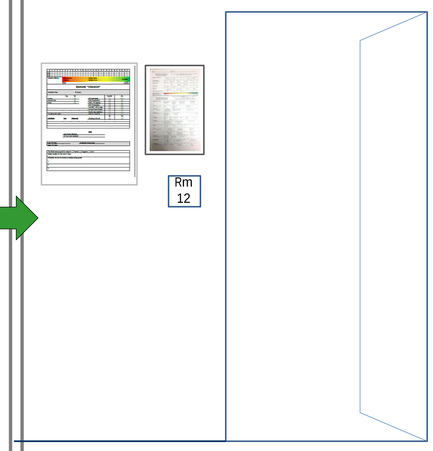
- Clinicians perceive patient condition along a continuum
- Two tools emerged from the data:
  - A "scales tool" that is granular and identifies clinician perception of patient status along the continuum of care.
  - A "checklist" tool for discrete data elements of care and to provide a summative report.





Task 4: Review and Update

- Once implemented, a continuous improvement process will occur with updates as needed.
- Prospective and retrospective data is collected to compare clinician perspectives and patient outcomes before and after POIP implementation.



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- *This study was conducted under a protocol reviewed and approved by the US Army Medical Research and Materiel Command Institutional Review board and in accordance with approved protocol*

Acknowledgements

- We would like to thank Nicole Caldwell, RN for her instrumental assistance in facilitating this project.
- Funding: This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011);

Comparing the Workload Perceptions of Determining Patient Condition and Priorities of Care Among Burn Providers in Three Burn ICUs

CPT Ian McInnis, DO, MS[1]; Sarah J. Murray, MSN, RN[2]; LTC (Ret) Maria L. Serio-Melvin, MSN, RN[2]; Jay K. Aden, PhD[2]; LTC Elizabeth A. Mann-Salinas PhD, RN[2]; LTC Kevin K. Chung, MD[2]
Todd Huzar, MD[3]; Steven Wolf, MD[4]; CAPT (Ret) Christopher Nemeth, PhD[5]; LTC Jeremy C. Pamplin, MD[2]

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The opinions or assertions contained herein are the private view of the author and are not be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Introduction

- The burn intensive care unit (BICU) is a data dense environment where clinicians from many disciplines work together to provide care
- Multidisciplinary rounds (MDR) is a collaborative activity designed to discuss patient data and formulate care plans
- MDR is associated with better outcomes in the ICU[1,2,3]
- Cognitive work associated with participation in MDR in the BICU has not been described
- The National Aeronautics and Space Administration Task Load Index (NASA-TLX) is a well-validated tool that quantifies workload associated with task completion on 6 subscales: Mental, Temporal, Performance, Effort, Frustration, & Physical[4]
- Higher workload, as measured by the NASA-TLX has been associated with poorer outcomes in the healthcare setting[5,6]

Objectives

- We sought to describe perceived clinician workload during MDR as measured by the NASA-TLX when completing 2 key tasks:

  Task 1: *Identify[ing] if the patient is better, same or worse than yesterday (Severity of Illness, SOI)*

  and

  Task 2: *Identify[ing] the most important objectives of care for the patient today (Priority of Care, POC)*

Methods

- This study was approved by an institutional review board
- It was conducted at 3 regional referral BICUs
- NASA-TLX was administered to a convenience sample of clinicians who participated in MDR after informed consent was obtained
- Participants included nurses, physicians, students and other providers (Dieticians, Respiratory Therapists, Pharmacists, Rehabilitation Therapists, etc.)
- Scores were analyzed using the nonparametric Wilcoxon's Test
- Significance was established when $p < 0.05$

Results

- A total of 116 completed surveys were collected from a group that included 41 physicians, 25 nurses, 13 students and 37 other providers
- Median total load for SOI was 40 (IQR:13-67), while median total load for POC was 43 (IQR:18-68)
- Mental demand, temporal demand, performance, and effort were principle contributors to the overall cognitive load
- Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15

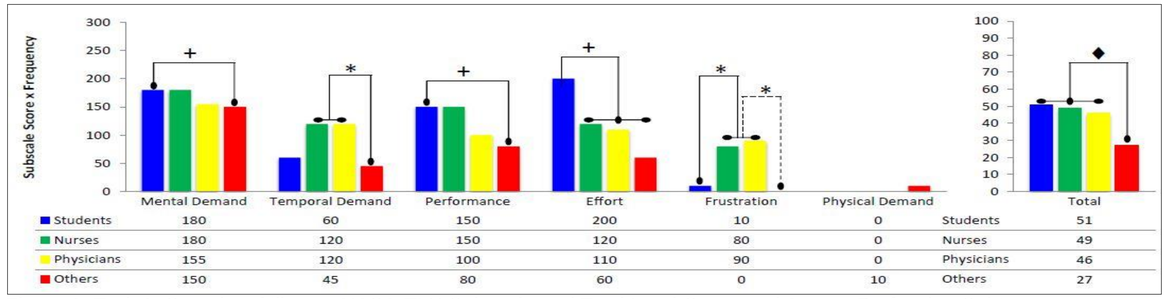

Figure 1. Task 1, Severity of Illness, NASA-TLX Subscale and Total Load Compared Among Profession Subtypes

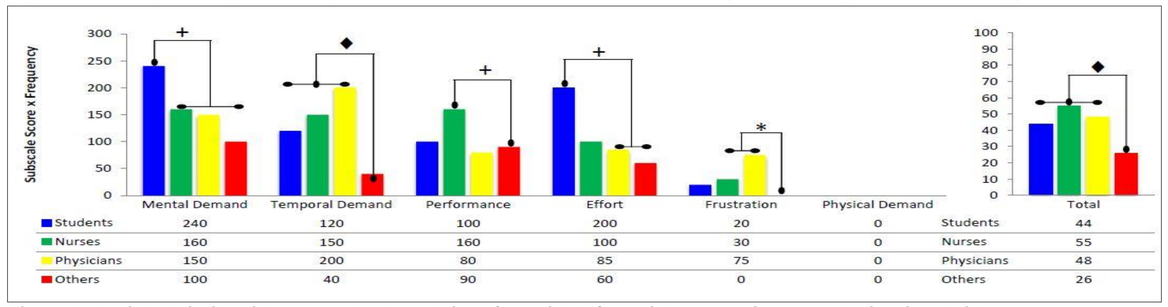

Figure 2. Task 2, Priority of Care, NASA-TLX Subscale and Total Load Compared Among Profession Subtypes

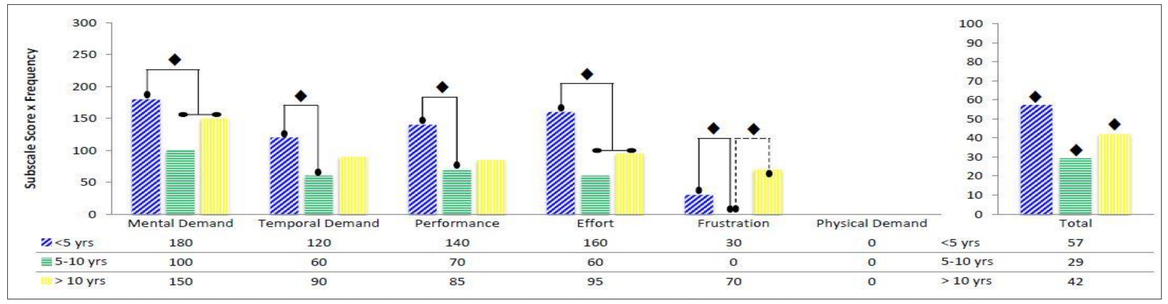

Figure 3. Task 1, Severity of Illness, NASA-TLX Subscale and Total Load Compared Among Experience Groups

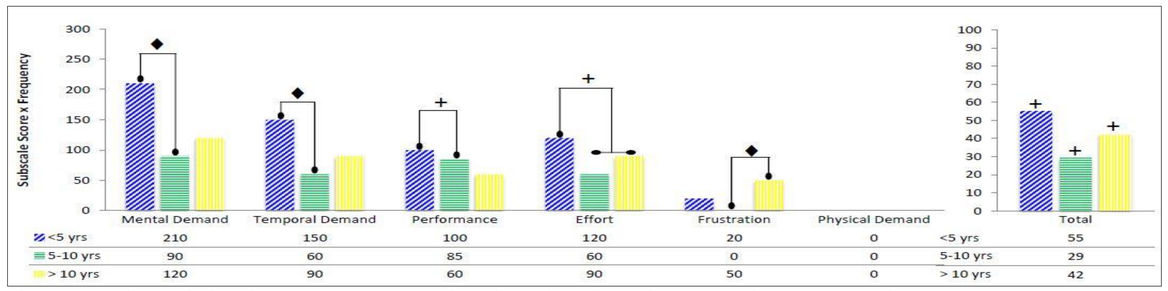

Figure 4. Task 2, Priority of Care, NASA-TLX Subscale and Total Load Compared Among Experience Groups

Significant between-group differences for figures 1-4 above indicated by brackets ($p<0.05$)

This study was conducted under a protocol reviewed and approved by the US Army Medical Research and Materiel Command Institutional Review board and in accordance with approved protocol

Conclusions

- There are differences in workload perception by members of the same multidisciplinary team
- Key Findings:
  1. Mental demand, temporal demand, performance, and effort were the primary determinants for the cognitive work performed for the SOI and POC on MDR
  2. students, nurses and physicians all had higher perceived total workload for both SOI and POC than “others”
  3. students perceived the most effort on rounds and had the most mental demand when identifying POC and significantly more than “others” when identifying SOI
  4. students, nurses, and physicians experience significantly more temporal demand when identifying POC than do “other” healthcare providers while only nurses and physicians perceive this significantly more than others for identifying SOI
  5. and clinicians with less experience have higher perceived workload when identifying SOI and POC as compared to those with more experience
- Identifying those with the highest workload may highlight those with the greatest potential to benefit from interventions to reduce workload
- The NASA-TLX tool a feasible tool to measure workload in the BICU environment

Acknowledgements

- Nicole W. Caldwell, RN Research Coordinator at the USAISR
- Agnes Burris, RN, Senior Research Nurse, and Christopher Tran, MBA at UT Southwestern Medical Center
- Adrian Botello, CSTR Trauma and Burn Research Coordinator at Memorial Hermann Hospital for their hard work and dedication to this project
- This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011)

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Perceptions of Teamwork in the Burn ICU

CPT Tara Brown, MD[1], Sarah Murray, MSN, Maria Serio-Melvin, MSN, James K. Aden, PhD, Elizabeth Mann-Salinas, PhD, LTC Kevin K. Chung, MD, FCCM, FACP, Todd Huzar, MD[2], Steven Wolf, MD, FACS[3], Christopher Nemeth, PhD[4], LTC Jeremy C. Pamplin, MD, FCCM, FACP

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Introduction

- The Burn Intensive Care Unit (BICU) is a complex care environment requiring a large multidisciplinary team to achieve optimal patient outcomes.[1]
- Good teamwork may improve patient outcomes.[2]
- The Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) is a validated survey to assess perceptions of teamwork amongst clinicians.[3]
- In this multicenter study we sought to measure teamwork perception at three burn center ICUs.

Objectives

- Measure perceptions of teamwork among different clinicians in three different BICUs

Methods

- We administered the TeamSTEPPS-Teamwork Perceptions Questionnaire (T-TPQ) to clinicians in three American Burn Association verified regional referral BICUs as part of an Institutional Review Board approved study.
- Admission rates from each site ranged from 270 to 300 patients per year, with an average daily census between 2 and 5.
- Clinicians surveyed included: physicians, nurses, and “others” (therapists, pharmacists, and staff not part of any other group). (Figure 2).
- Experience data collected and grouped as <5 years, 5-10 years, and >10 years.
- Scoring: A total score was calculated for each teamwork construct. Teamwork scores were dichotomized as acceptable for scores greater than 3 and needs improvement for scores less than 3.
- Wilcoxon’s nonparametric method for comparisons was conducted to compare the clinician types, sites and years of experience.

Results

- Surveys were returned from 129 clinicians across all sites (19 physicians, 87 nurses, and 23 others).(Figure 1)
- We found no significant difference between clinician groups, sites, or years of experience in perceived teamwork.
- Clinicians had a high degree of perceived teamwork (Table 1)
- The T-TPQ had good to excellent internal consistency and reliability for all scales (Cronbach’s alpha: .85-.92, Table 2).

Table 1. Means Scores and Standard Deviation of Each Perceived Teamwork Construct with Standard Deviation Based on Clinician Type

Clinician Type	Team Structure	Leadership	Situation Monitoring	Mutual Support	Communication
Physicians	28.6 ± 3.68	28.45 ± 3.28	28.95 ± 4.17	30 ± 3.83	29.1 ± 3.88
Nurses	27.34 ± 4.21	26.77 ± 5.23	27.25 ± 3.46	28.41 ± 3.86	28.65 +/- 3.38
Others	27.71 ± 4.6	28.33 ± 5.66	28.83 ± 3.9	27.83 ± 4.45	29 ± 3.16

Table 2. T-TPQ Cronbach's Alpha Reliability Coefficients

Teamwork Construct	Cronbach’s Alpha
Team Structure	0.83
Leadership	0.90
Situation Monitoring	0.85
Mutual Support	0.82
Communication	0.87

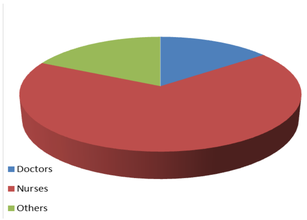

Figure 1. Breakdown of Surveyed Staff Across All Sites

Figure 3. Breakdown of TeamSTEPPS Team Competency Outcomes

Figure 2. Example of multidisciplinary rounds by the burn care team, which includes physicians, nurses, dieticians, physical and occupational therapists, respiratory therapy, wound care coordinators, and social workers.

Conclusions

- This is the first report using the T-TPQ to evaluate perceptions of teamwork in the BICU.
- Clinicians at all three sites gave highly favorable perception ratings for all aspects of teamwork evaluated.
- The T-TPQ is a valid tool to measure teamwork perception in the BICU.
- These results seem to suggest that teamwork in the BICU is perceived as being better than many other ICU environments.[4]
- Determining the underlying reason for better perceptions of teamwork found in the BICU may be used to improve teamwork and therefore patient outcomes in other ICU settings.

Acknowledgements

- Nicole W. Caldwell, RN Research Coordinator at the USAISR for her unparalleled and dynamic regulatory support and guidance;
- Agnes Burris, RN, Senior Research Nurse, and Christopher Tran, MBA at UT Southwestern Medical Center;
- Adrian Botello, CSTR Trauma and Burn Research Coordinator at Memorial Hermann Hospital; for their hard work and dedication to this project.

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Developing Cognitive Tools for the Intensive Care Unit: A Mixed Methods Approach

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LTC Kevin K. Chung, MD, FCCM, FACP[1],Todd Huzar, MD, FACS[2]; Steven Wolf, MD, FACS[3] ; CAPT (r) Christopher Nemeth, PhD[4];
& LTC Jeremy C. Pamplin, MD, FCCM, FACP[1]

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4. Applied Research Associates, Inc., Fairborn, OH

Introduction

- Medical care in the burn intensive care unit is complex and challenging.
- Checklists, support clinical decision making and communication
- Checklist tools must be ecologically valid, they must represent the work domain that they support in order to be effective
- We combined quantitative and qualitative data to create a valid evidence-based tool to enhance communication and provide clinical decision support.

Objectives

- To understand the work domain in the Burn ICU
- To create ecologically valid checklists
- Implement the Phases of Illness Paradigm
- To validate the Phases of Illness Paradigm
- To further develop the Phases of Illness Paradigm

Methods

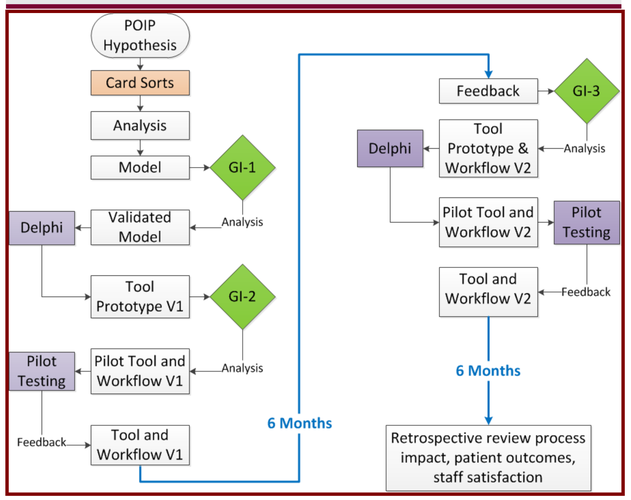

Figure 1: Methodology Model;Key: G1– Group Interview 1; G2—Group Interview 2; G3—Group Interview 3

- Demographic data also collected
- Delphi: Process to obtain group consensus

Results

- Fifty-five clinicians participated in card sorts that were validated by all clinician types (surgeon, nurse, respiratory therapist, etc.) in 3 group interviews.

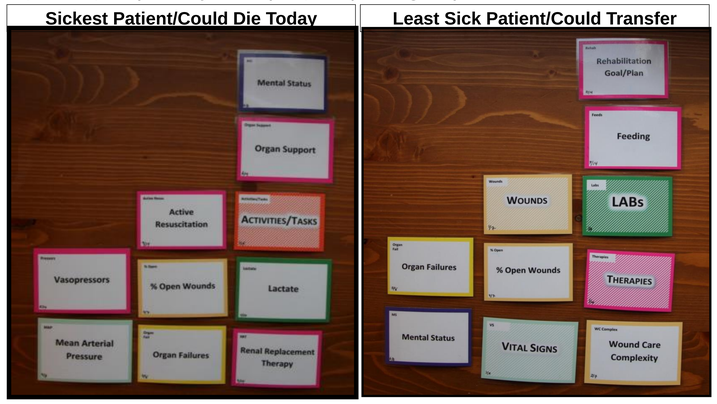

Figure 2: Feature Card Sorts

Card Sorts 77 Patients, 169 Card Sorts						
	Site 1		Site 2		Site 3	
	Patients	Sorts	Patients	Sorts	Patients	Sorts
Unique	19	60	51	73	7	36
Least	6	16	16	16	2	8
Middle	12	25	33	40	5	18
Most	9	19	12	17	5	10

Table 1: Card Sort by Site and Severity of Illness

Sorts by Clinician Type									
	Site 1 60			Site 2 73			Site 3 36		
	Least	Middle	Most	Least	Middle	Most	Least	Middle	Most
Total	16	25	19	16	40	17	8	18	10
Attending	2	8	3	2	2	2	2	3	1
Nurse	3	7	4	9	23	8	2	2	3
Other	7	4	6	2	7	5	1	8	3
Phys Train	4	6	6	3	8	2	3	5	3

Table 2: Card Sorts by Site and Clinician Type

- Senior staff (>10 years of experience) and key leaders participated in the Delphi process.

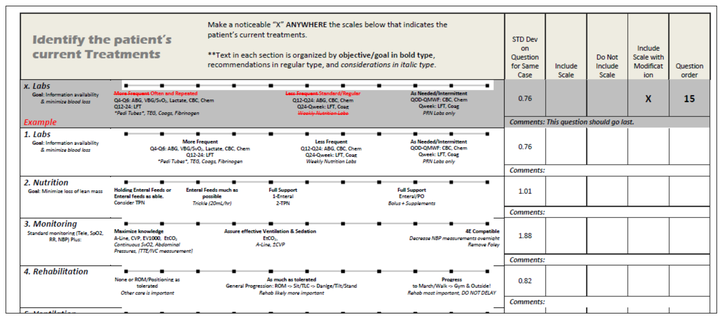

Figure 3: Delphi Tool

- We created two artifacts (tools) based on the data analysis: an at-a-glance (Team View) summary and a contextual conditional scales tool (Nursing Severity of Illness Assessment), posted outside each patient's door. Each site created unique tools. Site 1 shown here.
- The Team View is a communal display of coordinating activities that provides a longitudinal view of patient severity of illness, plan of care, daily treatment goals and the status of quality metrics such as bundle compliance.

Work Flow

- Bedside nurse updates Team View SOI
- Team updates daily treatment goals and plan of care
- Any team member can use the board to improve understanding of patient condition

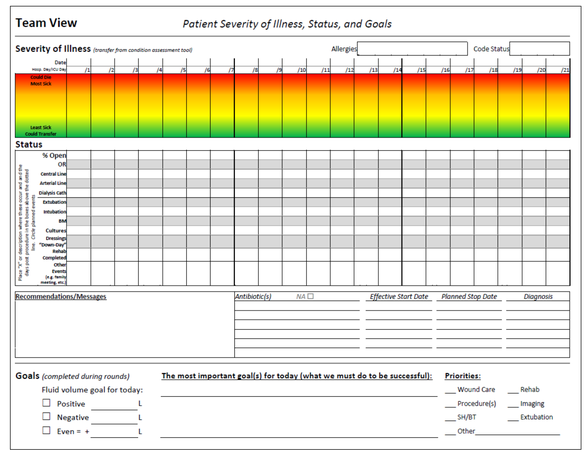

Figure 5: Team View Workflow

Work Flow

- Bedside nurse assesses patient: determines SOI
- Off-going nurse uses assessment for shift report communication
- On-coming nurse uses assessment to make treatment suggestions

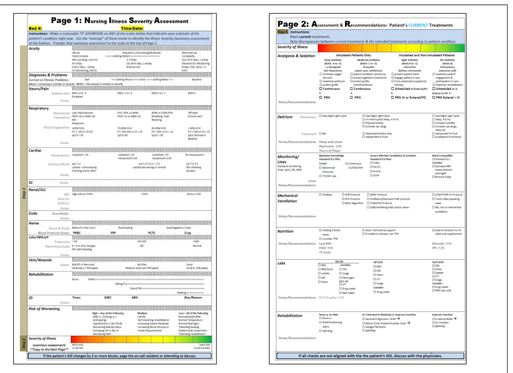

Figure 6: Nursing Illness Severity Assessment Tools and Workflow

Conclusions

- Mixed methods clinical research in the ICU provides a deeper understanding of the ICU as a work domain and can produce ecologically valid tools to support ICU clinician cognitive work
- Effective checklists create shared mental models, improve team communication, and may improve patient outcomes by improving priorities of care

Acknowledgements

Nicole W. Caldwell, RN Research Coordinator at the USAISR; Agnes Burris, RN, Senior Research Nurse, and Christopher Tran, MBA at UT Southwestern Medical Center; & Adrian Botello, CSTR Trauma and Burn Research Coordinator at Memorial Hermann Hospital; for their hard work and dedication to this project

This study was conducted under a protocol reviewed and approved by the Brooke Army Medical Center Institutional Review Board and in accordance with the approved protocol.

Revealing the different perceptions burn ICU clinicians have regarding patient illness severity and clinical treatments using card sort methodology

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LTC Kevin K. Chung, MD[1]; Todd Huzar, MD[2]; Steven Wolf, MD[3]; CAPT (Ret) Christopher Nemeth, PhD[4]; LTC Jeremy C. Pamplin, MD[1]

1. United States Army Institute of Surgical Research, Fort Sam Houston, TX 2. Memorial Hermann Hospital Texas Medical Center, Houston, TX 3. Parkland Health and Hospital System, Dallas, TX 4. Applied Research Associates, Inc., San Antonio, TX

Introduction

- The condition of each patient in the burn intensive care (BICU) is typically complex and requires comprehensive care from a diverse and robust multidisciplinary team
- The care team must communicate the daily care plan effectively so that all team members understand the patient's daily goals
- Care plans built upon a shared mental model provide care that is consistent, efficient, and able to meet the needs of the patient, resulting in good patient outcomes
- Often, individual BICU clinicians caring for the same patient have different perceptions, or mental models, about the patient condition and treatment priorities
- Differences in patient perception by members of the team reflect a lack of common ground and may impact effective teamwork and patient safety
- Card sorts are research tools that reveal human perceptions about information[1,2]

Objectives

- As part of a larger prospective observational study to create decision support tools and test the Phases of Illness Paradigm[3] in three burn ICUs, we sought to understand the different mental models that individual BICU clinicians have about their patients
- We sought to understand what differences in perception exist within the care team to reveal and understand how they might affect care decisions
- The result is an understanding of clinician perception differences that will impact the creation of communication tools to enhance team perception and improve patient care

Results

- 169 card sorts, 77 patients
- Average time: 35.5 ± 15.8 min [10-100 min]
- Average # Feature Cards: 9 ± 2 cards [3-16]
- Average # Treatment Cards: 8 ± 2 cards [3-14]
- Figures 3 and 4 demonstrate differences in clinician perception of SOI on same patient

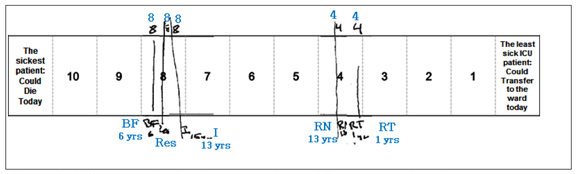


Figure 3: Differences in clinician perceptions of illness on patient A

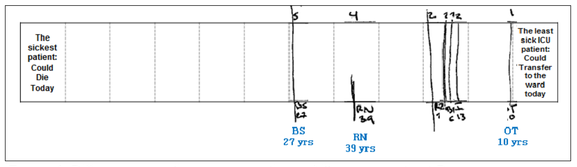
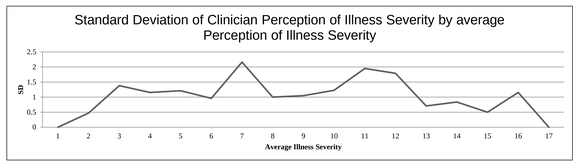
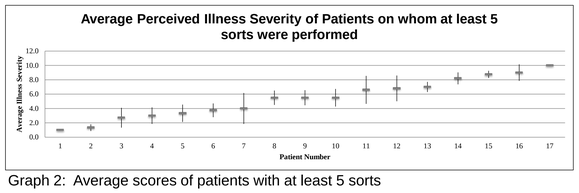


Figure 4: Differences in clinician perceptions of illness on patient B

- Perception of Illness Severity see graphs 1 & 2
- Greater distribution amongst clinicians in the middle sick category



Graph 1: Standard Deviation of clinician perception of illness severity



Graph 2: Average scores of patients with at least 5 sorts

- Word Clouds graphically display the mental models see figures 5, 6, and 7
- There are differences amongst different clinician types
- There are differences between clinicians in the same profession see figures 5 and 7

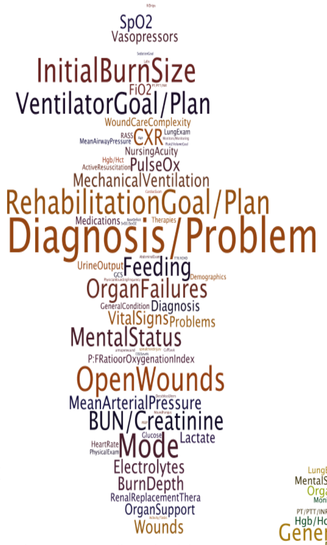


Figure 5: Attending Physicians 25 Card Sorts, 23 Patients

Figure 7: Residents 40 Card Sorts, 41 Patients

Figure 6: Bedside Nurses 61 Card Sorts, 56 Patients

Discussion

- We can reveal the differences in the way we think about our patients using card sort methodology
- We can use this information to expose differences and create tools to mitigate these differences and improve communication

Limitations

- Available cards may limit clinicians to only the cards that are presented despite having blank cards available
- Small sample
- May not be generalizable to other non-burn ICUs

Conclusions

- Burn ICU clinicians have different perceptions about patient condition and treatment priorities
- The card sort method successfully elicits mental models from clinicians during routine daily activity
- These models vary according to patient illness severity, clinician type, clinician experience, and institution

Methods

- We used Q-Methodology, or card sorting, to elicit how clinicians think about their patients
- We used 97 cards: 67 features and 30 treatments
- Clinicians were asked to identify a patient's condition on a scale from "could die today" to "could transfer today"

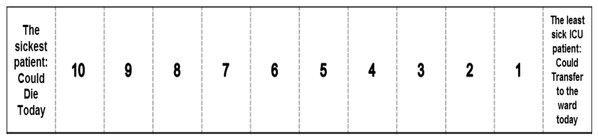


Figure 1: Severity of Illness continuous scale

- Cards were selected and arranged by priority

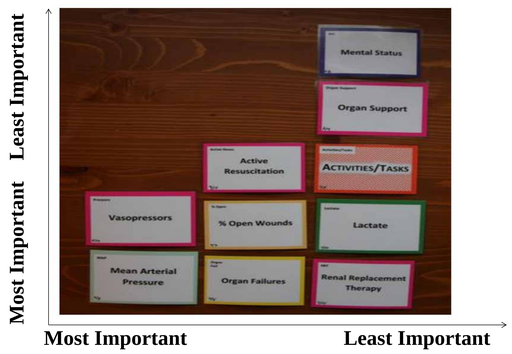


Figure: 2 Example of Card Sort with cards arranged from most to least important

- Terms were analyzed by frequency in category, clinician type, and compared between institutions

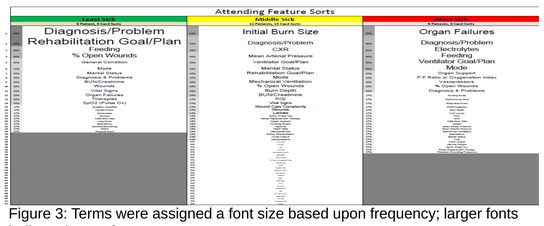


Figure 3: Terms were assigned a font size based upon frequency; larger fonts indicated more frequent

Acknowledgements

- We would like to thank Nicole Caldwell, RN for her instrumental assistance in facilitating this project
- Funding: This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011)

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Using Focus Group Interviews to Validate Team Communication Tools in the Intensive Care Unit

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Introduction

- Focus groups are a source of social knowledge, and represent a way to collect data interactively
- We used focus group interviews to validate checklist tools using the Phases of Illness Paradigm (POIP) model
- The POIP is a model that defines patients by Severity of Illness (SOI), aligning patient condition with treatments, with the intent of improving patient care by improving team understanding of patient condition, and team communication
- This study aimed to validate the POIP model and improve team communication through the creation and use of checklist tools

Methods

- This was a prospective mixed methods study in three academic regional referral Burn ICUs
- Convenience sample focus group sessions were conducted using case studies and semi-structured interviews
- The case studies were of patients in 3 SOI categories: most sick (could die today), least sick (could transfer today), and middle sick (all others) see figure 1
- Clinicians identified how sick the patient was along condition scales and rank ordered the treatments they felt were indicated for the patient that day
- The process was repeated using the POIP checklist tools
- We identified the differences between no tool and tool
- We used thematic analysis to identify codes and themes, we then used these data to update the POIP tools

Results

- We found no significant differences in determining SOI with or without tool use (n= 28 participants; 6 groups)
- Although statistical significance was not found, clinically important differences SOI ranking were observed and discussed
  - 34% of clinicians changed their initial SOI score after using the tool
- Clinicians chose SOI rank based on several themes
  - **Overall Picture:** the patient's entire status, not just one element
    - Includes premorbid condition and patient history
  - **Timing and Tolerance to Treatments:** whether or not the patient should be better at a moment in time
    - Includes the assumption of what the patient ought to be doing at a moment in their hospital stay
- Interviews suggested that the POIP tools might improve care prioritization by improving communication about patient SOI

Figure 1: The Phases of Illness Severity of Illness Scale

Table 1: PRIORITIES OF CARE BY SEVERITY OF ILLNESS

SOI	LABS	MON	MV	ACC	MEDS	CRRT	A&S	NUT	SLEEP	WC	REHAB
	8	8	7	8	8	7	6	3	4	4	3
	8	7	8	7	7	8	6	5	5	6	3
	5	8	3	5	3	5	3	5	5	5	3
	8	8	8	8	5	8	6	4	3	4	3
	7	6	8	7	7	5	7	6	6	7	4
	8	8	8	8	8	3	5	3	5	8	3
	8	8	8	5	8	8	5	5	3	5	3
	6	6	6	7	5	7	4	7	6	6	5
	5	8	4	6	6	6	6	7	6	6	6
	6	7	8	7	8	6	6	7	6	6	6
	7	5	5	6	6	8	5	5	7	8	6
	5	5	3	5	5	5	7	7	7	8	8
	3	3	8	5	5	8	5	8	5	3	8
	4	4	3	8	7	8	7	7	5	8	7
	3	3	3	4	5	4	7	4	7	7	6
	3	6	3	3	5	3	5	4	4	6	5
	3	3	3	3	3	5	5	3	3	8	5
	3	3	3	4	4	3	5	4	5	7	4

LEGEND: SOI: Severity of Illness; LABS: lab draws; MON: Monitors; MV: Mechanical Ventilation; ACC: Venous Access; MEDS: Medications; CRRT: Continuous Renal Replacement Therapy; SLEEP: Sleep; WC: Wound Care; REHAB: Rehabilitation.

MOST SICK
MIDDLE SICK
LEAST SICK
8 HIGHEST PRIORITY
5 MIDDLE PRIORITY
3 LEAST PRIORITY

Discussion

- Clinicians alter care priorities according to their perception of patient condition (SOI).
- Using a checklist tool to determine patient condition helps clinicians identify SOI more consistently.
- A shared understanding of patient condition and care priorities may improve communication, planning, and resourcing of patient care.
- Group interviews facilitated tool development by establishing end-user ownership and buy-in
- Clinicians prioritized care similarly based upon SOI, further validating the POIP model of care for use in the ICU see table 1
- Limitations: we did not audio/video record or transcribe the sessions

Conclusions

- Clinicians identified SOI according to their perception of overall patient condition and current trajectory
- Temporal and historical factors play important parts in determining how clinicians think about their patients and how they prioritize care
- Understanding team perception may improve communication and patient safety

Acknowledgements

- We would like to thank Nicole Caldwell, RN for her instrumental assistance in facilitating this project.
- Funding: This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011)

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Variations on a theme: How clinician descriptions of patient condition diverge

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3. Memorial Hermann Hospital Texas Medical Center, Houston, TX; 4. University of Texas – Southwestern Medical Center, Dallas, TX; 5. Applied Research Associates, Inc., Fairborn, OH

Introduction[1-5]

- Communication is a fundamental aspect of teamwork.
- Ineffective communication remains one of the leading causes of medical errors.
- People often assume their words convey an intended meaning.
- Descriptive terms that clinicians of different specialties and backgrounds choose are sometimes misunderstood or interpreted incorrectly.
- Effective teamwork requires a *shared mental model* of patient status, team resources, and goals that all team members understand, and, more importantly, *support*.

Objectives

- We sought to learn if there is any correlation between different clinician's perspective of patient illness severity and the terms they use to describe a patient's condition.

Methods

- This was a prospective, mixed methods study (survey plus interview) of clinicians in three academic, regional referral Burn ICUs.
- We asked clinicians during normal daily activities to identify terms they might use to describe "how sick" their patient was, or to offer their own terms.
- We also asked clinicians to identify "where" their patient was on a 1-10 scale indicating illness severity where scores of 1-3 indicated "least sick," 4-7 indicated "middle sick," and 8-10 indicated "most sick."
- We describe our findings using a contour plot, average illness severity per term, confidence intervals, and a "strength within group" statistic (the frequency a term is chosen within an group less its frequency chosen in other groups).
- This study was conducted under a protocol reviewed and approved by the US Army Medical Research and Materiel Command Institutional Review board and in accordance with approved protocol

Results

- We performed surveys and interviews with 169 clinicians caring for 77 unique patients: 25 staff physicians ("attendings"), 61 nurses, 40 residents, and 43 clinicians in other roles.
- On average, attendings chose 5±2 descriptors, nurses and residents chose 4±2 descriptors, and clinicians in other roles chose 6±2 descriptors.
- 8% of respondents added the following novel terms (with corresponding illness severity scores) not otherwise identified in pilot interviews: looks well (1), resource limited (2), just extubated (2), slightly combative when not sedated (3), geriatric patient (4, 4, 6), long-term rehab (5), wound infection (6), significant lung issues (6), poorly oxygenating (6), not ready for transfer (7), chronic critical illness (8), tenuous (9), critically ill (7 ,7, 9)
- There is a trend of terms that describe a patient's illness severity (figure 1).
- A priori analysis demonstrated that:
  - "Not sick" was chosen exclusively, but infrequency, for least sick patients.
  - "Shock like" and "actively trying to die" were chosen exclusively, but infrequently, in the most sick patients.
  - No term was chosen exclusively within the middle sick illness severity group.
  - "Ready for Transfer" had the strongest strength within group statistic and lowest average illness severity.
  - Three terms – "most interventions," "multiple organ failure," and "the sickest patient" – were consistent with an illness severity above 8 and had strength within group statistics of > 20%.
- If the most sick group included illness severity scores of 7-10, two additional terms, both including the work "profound" would be notable for describing the most sick patients.
- Confidence intervals for terms widely overlap illness severity scores (data not shown).

#surveys/group	11	13	16	20	23	15	25	25	13	8	169			
Illness Severity	1	2	3	4	5	6	7	8	9	10	Term Count	Mean Severity	A Priori Strength within Group	Final Strength within Group
Ready for transfer	91%	38%		5%				4%			17	1.9	0.34	0.34
Not Sick	9%	8%	19%								5	2.4	0.13	0.13
Just Monitoring	9%	15%	6%	10%		7%					7	3.1	0.06	0.06
Getting Better	45%	85%	31%	30%	17%	13%	4%	8%			36	3.4	0.32	0.32
Stable	73%	38%	75%	70%	30%	20%	8%	8%			53	3.6	0.27	0.27
Improving	55%	77%	69%	30%	39%	7%	12%	16%	8%		51	3.8	0.34	0.34
Going in the right direction	55%	69%	56%	50%	48%	20%	16%	12%	15%		57	4.1	-0.37	0.15
Normotensive	36%	15%	44%	30%	22%	27%	28%	8%		13%	38	4.7	-0.13	-0.13
Stabilized	27%	31%	25%	40%	30%	53%	28%	8%	8%		44	4.8	0.02	0.02
Medium Sick	18%	8%		35%	30%	20%	12%	8%			25	4.9	0.12	0.12
Ventilated	9%	15%	44%	55%	61%	53%	72%	60%	69%	38%	88	6.2	-0.22	-0.22
Infected	9%			20%	17%	27%	36%	24%	38%	13%	34	6.7	-0.03	-0.03
Critically Stable			6%	5%	43%	40%	64%	48%	15%	13%	49	6.7	0.05	0.05
Getting Worse				5%		7%	12%	20%	23%	13%	14	7.7	-0.14	0.14
Profound lung injury		8%		5%		7%	4%	20%	38%	38%	17	7.9	-0.27	0.22
3+ sick					4%	7%	4%	12%	23%	13%	10	7.9	-0.12	0.12
Profoundly ill				10%		7%	28%	40%	85%	25%	33	7.9	-0.38	0.38
Most Interventions				5%		7%	16%	24%	23%	50%	19	8.1	0.21	0.21
Multiple Organ Failure				5%	4%	7%	4%	24%	23%	50%	17	8.1	0.23	0.23
In Shock							4%	4%	31%		6	8.5	0.10	0.10
The sickest patient						7%	4%	28%	38%	88%	21	8.8	0.39	0.39
Shock Like								4%	23%	13%	5	9.0	0.11	0.11
Actively trying to die								4%	8%	25%	4	9.3	0.09	0.09

Figure 1. Contour plot showing the frequency of terms chosen according to patient illness severity as indicated by clinicians. Percentage = the count of a term divided by the number of surveys/illness severity score. Also shown are the number of times a term was chosen overall (**term count**), the mean illness severity for which a term was choses (**mean severity**), and the difference between the frequency a term was chosen within the A Priori Group (least sick = 1-3, middle sick – 4-7, most sick = 8-10) and Final Group (where most sick = 7-10) vs. outside the group (**strength within group**). This statistic helps differentiate terms that are used often (i.e. by many clinicians) and are consistent with a particular illness severity group. Of note, illness severity in reality is not *discrete*: it represents a continuum of patient condition. Here, we try to demonstrate that with a gradient of color whereas in the analysis we uses three discrete groups.

Discussion

- Clinician terminology poorly differentiates patient illness severity, although a general trend in terminology exists.
- Terms that indicate extremes of illness differentiate between most sick and least sick Burn ICU patients, but have limited differentiation between these groups and middle sick patients.
- Changing illness severity groupings changes the strength within group statistic, but does not change conclusions significantly.
- Limitations:
  - This was not an exhaustive list of terms: clinicians may have anchored to the terms presented instead of using their own terms.
  - Patient illness severity is a continuous variable, yet we have analyzed it discretely.

Conclusions

- Lack of a shared understanding with respect to patient condition degrades teamwork and increases risks to patients through dyssynchrony of care.
- Improving team understanding about patient condition by standardizing descriptive terminology might improve communication and patient care.

Acknowledgements

- We would like to thank Nicole Caldwell, RN for her instrumental assistance in facilitating this project.
- Funding: This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011)

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#888

Achieving Ecological Validity: Creating Decision Support Tools for the Burn Intensive Care Unit

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James K. Aden, PhD[1]; COL Elizabeth A. Mann-Salinas PhD-RN[1]; LTC Kevin K. Chung, MD[1]; CAPT (ret) Christopher Nemeth, PhD[2]; LTC Jeremy C. Pamplin, MD[1]
1. United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX 2. Applied Research Associates, Inc., Fairborn, OH

Introduction

- Multidisciplinary teams in the burn intensive care unit (BICU) are large, comprised of clinicians from multiple different clinical backgrounds[1]
- Teamwork and communication are essential in the care of the critically ill burn patient[1]
- Substantial evidence supports using checklist tools to support clinical decision making for the critically ill[2-8]
- In order for tools to be useful, they must be *Ecologically Valid*- or represent the work domain they intend to support[9,10]

Theoretical Underpinnings

- The Phases of Illness Paradigm (POIP) is a theory that defines patients by severity of illness (SOI) and aligns treatment to patient condition
- Decision support tools based on the POIP enable shared mental models which enhance communication, efficiency, and care delivery.

Figure 1: The Phases of Illness, Severity of Illness Scale

Objectives

- We sought to create ecologically valid clinical decision support tools for the BICU based upon the POIP model

Methods

- This was part of a prospective mixed methods study in three academic regional referral Burn ICUs
- After the first 6 months of tool use, we assessed user satisfaction using a 10 question 5-point Likert-like scale
- Although intended to enhance team communication, the burden of tool completion was placed on nurses.
- For statistical analysis we reduced the scale from 5 points to 3 points: agree, neutral, and disagree

Results

- We surveyed 48 end-users (response rate?) (Physicians: 3; Nurses: 30; Others: 15)
- Two tools were created, see figure 2
- Mean Overall satisfaction scores were 3.23 (SD 0.98)
  - Fewer participants rated very low/low (20%) compared to those rating very high/high satisfaction (44%) and those that were neutral (35%)
  - Physicians were more satisfied than nurses: 100% Satisfaction (n =3) vs. 36% dissatisfaction (n=30)
- ~~See graph to right for combined scores (n=48)~~

Figure 2: Two tools

Burn Illness Severity Assessment tool

A. Clinicians assess patient along 6 continuous scales

B. Clinicians determine SOI and make a mark along the rainbow patterned scale

C. Treatments are checked off along each of the 12 scales
   - Clinicians assess the appropriateness of treatments for the SOI category

The TeamView board is located outside each patient's room

E. Clinicians update the daily SOI along the top rainbow patterned area

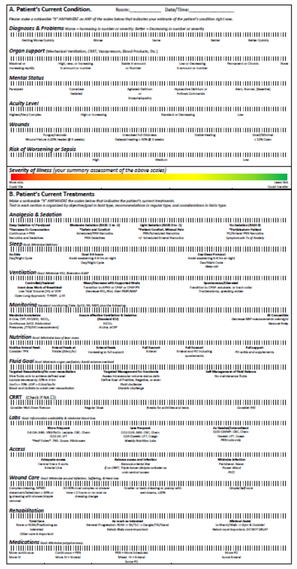
F. Daily events: tube and line changes are tracked below

G. There is space for messages, and antibiotic start and stop dates are tracked

H. On rounds, the care team updates the overall daily goals & fluid goals

I. Priorities of care are determined and noted on the board

A.



B.

C.

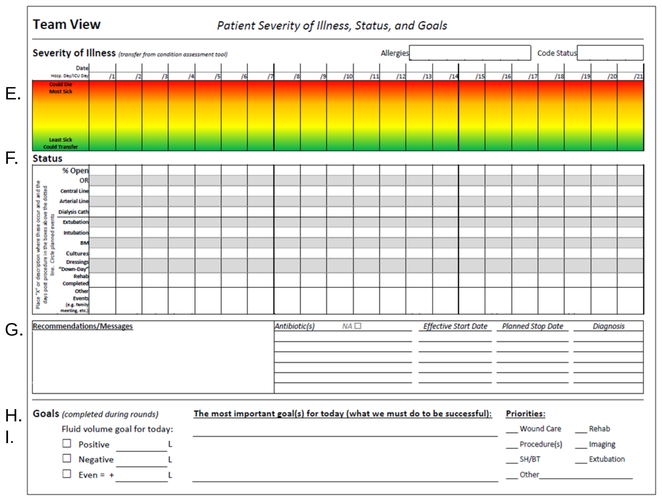
E.

F.

G.

H.

I.



Discussion

- Creating tools to support clinical work requires frequent feedback from end users in order to produce a tool that is ecologically valid and useful
- Overall, clinicians did not feel the tools interfered with work, but also did not think the tools greatly improved their patient understanding or patient outcomes
- Using this data, we shifted the burden of tool completion from nurses to residents and team during multidisciplinary rounds
- Daily use of the TeamView has been more routine since that time.

Conclusions

- The POIP checklist tools supported teamwork and communication without interfering with workflow for most participants
- After 6 months of use, most clinicians were comfortable with the tools yet daily use was lower than expected
- We used this data to update tools to improve use for both

Acknowledgements

- We would like to thank Nicole Caldwell, BA-RN, for her help with this poster, regulatory support, and guidance
- Thanks to the clinical staff who participated in this study

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This study was conducted under a protocol reviewed and approved by the Brooke Army Medical Center Institutional Review board and in accordance with approved protocol.

Getting the Burn Team to play from the same playbook: Understanding clinician perception of patient condition

LTC Jeremy C. Pamplin, MD, FCCM, FACP[1,2], Sarah J. Murray, PhD(c), MSN, RN[1], LTC(Ret) Maria Serio-Melvin, MSN, RN[1], James K. Aden, PhD[1], Todd Huzar, MD, FACS[3], Steven E. Wolf, MD, FACS[4], LTC(P) Kevin K. Chung, MD, FCCM, FACP[1,2], COL Elizabeth A. Mann-Salinas, PhD, RN, FCCM[1]

1. United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX; 2. Uniformed Services University of the Health Sciences, Bethesda, MD;
3. Memorial Hermann Hospital, Texas Medical Center, Houston TX; 4. University of Texas, Southwestern Medical Center, Dallas, TX

Introduction

- Critical care of burn patients requires a multi-professional team of clinicians
- They must effectively collaborate in order to ensure optimal outcomes
- Effective teamwork necessitates team members share common goals
- Establishing goals requires a shared mental model of a patient's current condition, anticipated future state, and treatments to bridge the two
- Better understanding of how clinicians understand patient condition, and ultimately treatment priorities, could improve teamwork, communication, and patient outcomes

Objectives

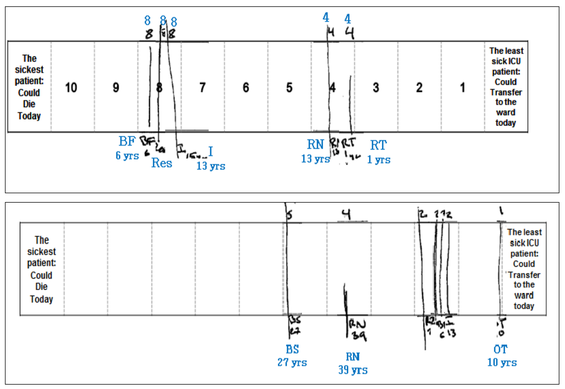
- We sought understand how a team of clinicians perceive patient condition, and measure the impact of a burn specific illness severity assessment tool on team understanding

Methods

- This was part of an IRB approved, prospective, mixed methods study to understand clinician perspectives about patient condition and treatment priorities
- This understanding was used to create tools that could improve clinician decision making, teamwork, and communication according to the Phases of Illness Paradigm
- Clinician perspectives were elicited through survey and card sort methodology
- Tools were created through using data obtained from card sort (see figures 1 & 2) and refined by focus groups, the Delphi process for consensus building, and pilot testing
- To identify the impact of these tools on the mental models clinicians form about patient condition, we asked clinicians to identify their patient's *current* and *anticipated* condition on the following day by marking a continuous scale from "Most sick/Could die today" to "Least sick/Could transfer from the ICU today"
- Continuous scales divided into ten equal parts and the location of a clinician's mark upon them was scored from 10 (most sick) to 1 (least sick)
- We then evaluated the variance of the differences between clinician perspective before beginning the project (pre-baseline), before implementing tools (baseline), and six months after implementing tools

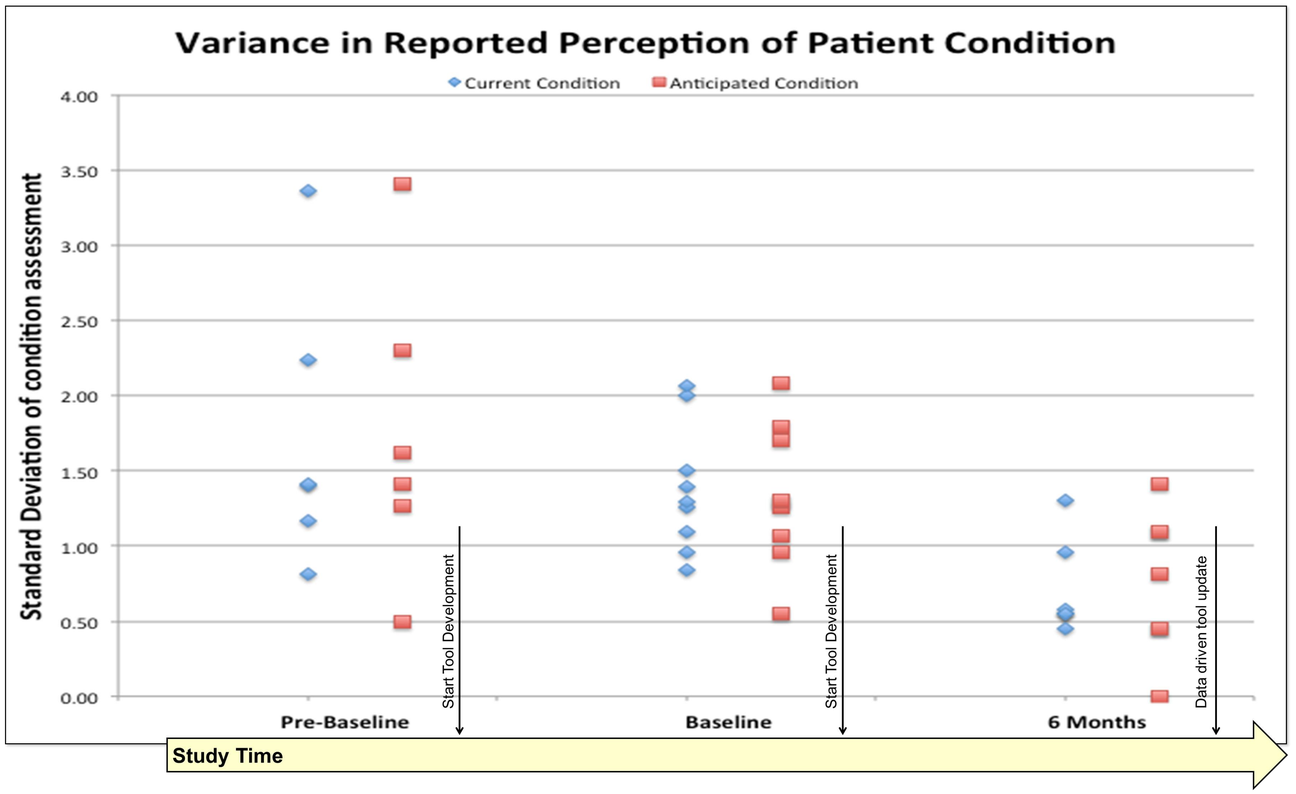
Results

- The average variance reflecting clinician perception of a patient's current and anticipated condition was as follows:
  - pre-baseline, ±1.73 and ±1.37 see graph below
  - baseline, ±1.38 and ±1.33
  - six months, ± 0.7 and ±0.76
  - The decreased variance for both current and anticipated condition was statistically significant at each time point (ANOVA, P = 0.01)



Figures 1 &2: Pre-Baseline Card Sort Survey Examples

- Two examples from a concurrent study demonstrating the differences amongst clinicians in perceiving patient SOI
- Pre-baseline and baseline CUS data were similar to these examples



Discussion

- The process of developing tools that identify clinician perception about patient condition and treatment priorities changed how clinicians consider patient illness before these tools were introduced to the BICU (pre-baseline to baseline)
- Introducing a burn illness assessment tool developed through a mixed methods research further improved agreement between clinicians about patient condition
- Improving the team's perception of a patient's current and future state has the potential to improve teamwork by creating a better, shared mental model of the patient and care priorities
- Patient care outcomes are likely improved by better teamwork and improved team communication regarding patient illness severity, daily goals, and treatment priorities

Conclusions

- Developing and implementing tools according to the Phases of Illness Paradigm resulted in improved clinician agreement about patients' current and anticipated condition
- These tools can help clinicians asses a patient's current condition and anticipated best treatments

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Acknowledgements

Thank you to: Nicole W. Caldwell, RN Research Coordinator at the USAISR for her unparalleled regulatory support and guidance; Agnes Burris, RN, Senior Research Nurse and Christopher Tran, MBA at UT Southwestern Medical Center; & Adrian Botello, CSTR Trauma and Burn Research Coordinator at Memorial Hermann Hospital for their hard work and dedication to this project.

This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011).

This study was conducted under a protocol reviewed and approved by Brooke Army Medical Center Institutional Review board and in accordance with approved protocol

Understanding Clinician Perspectives of Patient Condition and Care Goals in the Burn Intensive Care Unit

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3. University of Texas – Southwestern Medical Center, Dallas, TX; 4. Applied Research Associates, Inc., Fairborn, OH

Introduction

- Patient care in the burn intensive care unit (BICU) is complex and involves large multidisciplinary teams
- If team members are not working toward common goals, communication, efficiency, synchronization, and ultimately patient safety may be compromised
- The Phases of Illness Paradigm (POIP) is a theoretical model that defines patients by severity of illness, aligning patient condition to treatments
- Understanding how clinicians perceive patient condition and associated care goals is necessary to develop ecologically valid tools to support their daily work

Objective

- To understand how clinicians perceive patient condition and associated care goals and the degree to which individual team members share the same mental model of the patient

Methods

- A "Condition Understanding Survey" was created to assess clinician's perception of the Patient's Severity of Illness (SOI) and associated care goals
- Surveys were administered during normal patient care duties and clinicians were asked to:
  - rate patient SOI on a 10 point scale from "most sick" (10) to "least sick" (1)
  - prioritize goals of care
- A goal was defined as "a near-term desirable outcome for the patient. There may be more than one goal . These should be patient focused."
- We collected clinician perspectives on at least two patients in each of the following groups : least sick: 1-3; middle sick: 4-7; most sick: 8-10
- We evaluated goal agreement between clinicians for patients with whom we obtained responses from at least 3 clinicians on the basis of the same goal appearing in any of their top 4 responses
- The authors coded responses to ensure they matched the definition of goal and for thematic analysis
- Adjudication occurred by majority vote

Results

- Overall, there were 169 responses from 60 respondents goals. Only 95 responses (57%) met the definition of goal (example below, table 1)
  - The most common goals were are shown in figure 1
  - Only six patients had at least three clinicians that responded. Comparisons between clinician responses for this six patients showed:
  - 28% +/- 17% agreement about top care priorities
  - Clinicians perceived SOI more consistently in patients who were "most sick" than in patients who were "middle sick" (figure 2)

Table 1. Example of raw and coded data.

Original Category	Utterance	Coded Category	Coded Utterance
Goal	Maintain oxygenation and ventilation	Goal	Adequate oxygenation and/or ventilation
Goal	Skin grafting	Objective	Surgical operation (implicit goal = achieve wound healing)

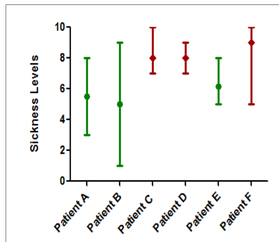

Fig 2. Reported sickness severity levels (mean with range)

Fig 1. Coded goals in middle and most sick patients

Discussion

- This data suggest clinicians may have widely different beliefs about patient condition and care priorities
- Of the top care 4 goals identified by clinicians most were not shared by other clinicians
- Lack of common ground likely increases risk to patients and decreases care efficiency, coordination, and synchronization
- Interestingly, the majority of coded goals (66% in each SOI group) could be represented by a small number of themes
- Identifying common goals – and care plans, protocols, or pathways around them – for different patient types, whether according to patient SOI as in this project, or by some other grouping (i.e. disease process), should improve patient care by improving team performance

Conclusion

- Clinicians in the BICU do not share a common mental model of patients or care priorities
- Creating common ground amongst care providers should decrease variance and improve team performance, patient care, and ultimately patient outcomes
- This might be accomplished by creating protocols to address frequent goals, thus reducing complexity an increasing opportunity to discuss differences

Acknowledgements

- Thank you to Nicole Caldwell, BA-RN, for regulatory assistance with this project
- This project is supported by a grant from the US Army Medical Research and Materiel Command Telemedicine and Advanced Technology Research Center (TATRC) (W81XWH-13-2-0011)

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Discloser

This study was conducted under a protocol reviewed and approved by the Brook Army Medical Center Institutional Review Board and in accordance with the approved protocol.

Journal of Burn Care & Research

Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs

--Manuscript Draft--

Manuscript Number:	JBCR-D-15-00153R2
Full Title:	Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs
Article Type:	Original Article
Keywords:	Teaching Rounds; Intensive Care; Cognitive Work; Task Performance and Analysis
Corresponding Author:	Jeremy C. Pamplin, MD US Army Institute of Surgical Research JBSA Ft. Sam Houston, TX UNITED STATES
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Abstract:	Introduction: Multidisciplinary rounds (MDR) in the Burn Intensive Care Unit serve as an efficient means for clinicians to assess patient status and establish patient care priorities. Both tasks require significant cognitive work, the magnitude of which is relevant because increased cognitive work of task completion has been associated with increased error rates. We sought to quantify this workload during MDR using the National Aeronautics and Space Administration Task Load Index (NASA-TLX). Methods: Research staff at 3 academic regional referral burn centers administered the NASA-TLX to clinicians during MDR. Clinicians assessed their workload associated with 1) "Identify[ing] if the patient is better, same, or worse than yesterday" and 2) "Identify[ing] the most important objectives of care for the patient today." Data were collected on clinician type, years of experience, and hours of direct patient care. Results: Surveys were administered to 116 total clinicians, 41 physicians, 25 nurses, 13 medical students and 37 clinicians in other roles. Clinicians with less experience

	reported more cognitive work when completing both tasks (p<.005). Clinicians in the "others" group (respiratory therapists, dieticians, pharmacists, etc.) reported less cognitive work than all other groups for both tasks (p<0.05). Conclusions: The NASA-TLX was an effective tool for collecting perceptions of cognitive workload associated with MDR. Perceived cognitive work varied by clinician type and experience level when completing 2 key tasks. Less experience was associated with increased perceived work, potentially increasing metal error rates and increasing risk to patients. Creating tools or work processes to reduce cognitive work may improve clinician performance.

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REPLY TO
ATTENTION OF

10 July 15

Dear Dr. Gamelli,

Thank you for accepting and allowing us to revise again our manuscript JBCR-D-15-00153, entitled "Comparing the workload perceptions of determining patient condition and priorities of care among burn providers in three burn ICUs." We are greatly appreciative of the thoughtful commentary by your reviewers which again has improved the quality of our manuscript. Individual responses to your reviewers concerns are below.

I hope these revisions adequately address your concerns. Please do not hesitate to contact me directly if there is anything I can do to help facilitate review and/or revision.

Kind regards,

JEREMY PAMPLIN, MD, FCCM, FACP
LTC, MC, USA
Medical Director, Burn ICU
Chief, Clinical Trials in Burns and Trauma
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Reviewer #2:
I detected one remaining typo. In the revisions on page 12 there is a statement "....least about of total cognitive work..."

- *Corrected. Thank you.*

I believe the revisions have improved the paper. There will always be criticism of data from a "convenience sample of volunter subjects" but I believe the alternative of mandating completion of the data forms from every participant in rounds would result in some forms being filled out superficially just "to get them done". The latter option would not necessarily produce more reliable data.

- Thank you.

Reviewer #3:

The authors have substantially improved their manuscript. As indicated in my earlier review, I cannot too highly praise this paper. It will have significant impact on the human factors describing burn care and will likely trigger new directions in the organization and delivery of care in burn centers. The suggestions below are meant to improve an already excellent paper and to answer a few questions that continue to intrigue me.

- Thank you.

First, I would like to emphasize that the ICU experience is only a small portion of the total treatment of "burn disease". It appears to me that the authors view burn critical care as an isolated and nearly independent part of burn care, even to the point of suggesting the ICU staff should be formally separated from the post-injury courses of burned patients. Whether increased fragmentation of care proves to be beneficial to patients remains to be seen, but the authors' methodology will likely be the best way to measure these effects.

- We agree that the ICU experience is only a part of a burn patients' overall burn care. We did not intend to imply that the ICU experience nor the clinical teams should be separated. We certainly did not study this nor did we present data about this. In all of the centers involved in this project, clinicians representing all locations of a patient's care (ICU, Ward, Clinic) and all professions contributing to it (intensivist, surgeon, RT, rehabilitation (OT & PT), social work services, nursing, nutrition, etc.) participate in patient care. Unfortunately, our convenience sample was not able to obtain data from all of these clinicians types.

Admittedly, the study sample is quite small, especially in relation to all of the pertinent variables involved. Much more data will be needed to potentially eliminate some of the non-normal distributions. The "other" group is particularly problematic, in that this group is overwhelmingly composed of the more experienced clinicians, particularly for the clinicians who may be "too old" to work on a burn unit. The fact that only one OT represents the Rehab disciplines is eye catching. As one of the pillars of the ABA, the lack of representatives of Rehab group is of concern - does the sample represents the distribution of the "other" in the individual units?

- No, our study distribution of "others" does not represent the actual distribution of "others" caring for patients in the burn center. Our primary target population was nurses and physicians in this protocol since these groups represented the largest proportion of clinicians caring for burn patients on any given day. Also, these groups have the greatest distribution of experience for us to examine.

Table 1 lists n = 11 burn surgeons, but the subgroups add to 31.

- *Great catch! Fixed.*

Further, are none of the burn surgeons surgical intensivists?

- We did not collect this data specifically in this project, but the majority of the burn surgeons in this project were also surgical intensivists. We have added the term “medical” before intensivist throughout the manuscript for clarification.

In the same table, is "average experience" the duration of medical training or the time spent in burn centers.

- This was the time since graduation from licensing school or year in school for students. We have added this information to the manuscript.

If the figure represents time since medical school graduation, a separate column indicate full time burn center assignment should be provided.

- Unfortunately, we did not collect this information.

Particularly in the military burn center, many of the assignments are short term (less than 5 years) rotators.

- Agree.

I feel strongly that the military burn center should be identified by site - is it site 2 ??

- We are uncertain as to how we should respond to this request. We do not feel that including this information will add additional insight to the manuscript. The military center was not site 2.

In particular, if it is site 2, as is my guess, I think the authors have made a phenominal observation about the remarkable effectiveness of the military philosophy of education and leadership that would be beneficial to resolution of many of the shortcomings suggested in this study. The authors might concult Dr Gamelli to see if this would be acceptable.

- No response.

This reviewer would be a member of the "> 10 yrs" group. What's wrong with us? Should we leave clinical care or choose a new specialty? Hopefully, in the fullness of this research, you will be able to answer such questions. I should point out that many burn units have only a few daytime physician extenders and no residents. The attendings are on both attending call and resident call 24/7 and these duties certainly constitute workload. Could you better describe this group of clinicians?

- We are unclear as to which group of clinicians this reviewer would like us to describe (attending in general, clinicians with > 10 yrs experience, or attending that perform both “attending” and

"resident" duties during a 24/7 call) and what constitutes "better?" We did not collect additional demographic information for any of these groups.

Please better describe your statistical considerations and methods. You indicate that you used Wilcoxon and Steel-Dwass techinques. What's the difference? What does it mean when one method is significant and the other is not? What does it mean when both are significant?

- We have edited the manuscript to reflect that we used the Wilcoxan Test *with* the Steel-Dwass correction and provided a reference. The Steel-Dwass correction provides a means to make non-parametric data appear more "normal" in distribution before performing statistical comparisons. When you use the Steel Dwass adjustment, you increase the p-value due to increases in the false positive rate. Therefore, Steel-Dwass is conservatively decreasing the chances of a type-1 error. The Steel-Dwass is less likely to be significant over just doing a Wilcoxon Test alone.

Finally, I would suggest further emphasizing the utility of the NASA-TLX instrument as an effective instrument for assessing not just human factors but also for evaluation team effectiveness and maybe even adequacy of staffing in the burn center. For example, was there less frustration at site 2 because it had a lower average census?

- These are thought provoking observations. Unfortunately, we did not collect data to address these considerations in this project, but they represent great ideas for future study!

There are a number of grammatical errors persisting in the manuscript, especially in the latter half of the Discussion. I would like to emphasize that the authors are excellent writers - the manuscript was a pleasure to read. Reference 11 lacks the name of its journal in the citation. As stated above there appears to be a numerical inconsistency in Table 1.

- We have, hopefully, corrected all of the grammatical errors.
- We have added the journal for the citation.
- Table 1 has been corrected as above.

My curiosity has got the best of me. What did Nicole Caldwell do for this paper? Given the potential magnitude of this work, she certainly deserves her recognition.

- She facilitated our regulatory approvals and administrative support of this project. This has been added to the manuscript.

Title: Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs.

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Title: Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs.

Abstract

Introduction:

Multidisciplinary rounds (MDR) in the Burn Intensive Care Unit serve as an efficient means for clinicians to assess patient status and establish patient care priorities. Both tasks require significant cognitive work, the magnitude of which is relevant because increased cognitive work of task completion has been associated with increased error rates. We sought to quantify this workload during MDR using the National Aeronautics and Space Administration Task Load Index ~~survey~~ (NASA-TLX).

Methods:

Research staff at 3 academic regional referral burn centers administered the NASA-TLX to clinicians during MDR. Clinicians assessed their workload associated with 1) "Identify[ing] if the patient is better, same, or worse than yesterday" and 2) "Identify[ing] the most important objectives of care for the patient today." Data were collected on clinician type, years of experience, and hours of direct patient care.

Results:

Surveys were administered to 116 total clinicians, 41 physicians, 25 nurses, 13 medical students and 37 clinicians in other roles. Clinicians with less experience reported more cognitive work when completing both tasks ($p<.005$). Clinicians in the "others" group (respiratory therapists, dieticians, pharmacists, etc.) reported less cognitive work than all other groups for both tasks ($p<0.05$).

Conclusions:

The NASA-TLX was an effective tool for collecting perceptions of cognitive workload ~~data~~ associated with MDR. Perceived cognitive work~~load~~ varied by clinician type and experience level when completing 2 key tasks. Less experience was associated with increased perceived work, potentially increasing metal error rates and increasing risk to patients. Creating tools or work processes to reduce cognitive work~~load~~ may improve clinician performance.

Key Words

1. Teaching Rounds
2. Intensive Care
3. Cognitive Work~~load~~
4. Task Performance and Analysis

Introduction

The burn intensive care unit (ICU) presents a challenging work environment to the healthcare team. Effective care requires the coordinated effort of healthcare professionals from different backgrounds, each member contributing unique perspective toward a common goal. These teams are a necessity given the complexity of managing the medical, administrative, and social aspects of patient care. Multidisciplinary rounds (MDR) is an event that facilitates communication of relevant information among team members and is associated with better outcomes in the ICU.[1,2,3]

While MDR represent a powerful tool and a logical means for efficient dissemination of information, there is variability in the quality and effectiveness of such rounds. MDR must encompass key aspects of care, to include problems, plans, and goals. The multidisciplinary team must be effectively *managed* to ensure that all important aspects of patient care are addressed. Caution must also be taken to ensure that information is discussed clearly and in such a way that it is accessible to all ~~of the~~ members of the team who need it; thus, helping to avoid the need for inefficient clarifications with individual team members after MDR have ended.[4] Input from all team members must be evaluated and integrated by the team leader, typically a physician, in such a way as to create a cohesive, prioritized care plan.[2]

A series of decisions are made during MDR, some critical, some routine. Likewise the ~~mental~~ cognitive work that goes into making these decisions is variable. In the same way that physical work is defined in terms of distance and force, ~~mental~~ cognitive work can be imagined as a function of a task and the perceived effort required to complete~~ing~~ it. Different people ~~would~~ have different perceived workloads when completing the same task according to their familiarity with the task and their overall experience with the task or similar tasks.[5] Calculating workload by this definition requires quantification of perceived mental "force." Hart and Staveland developed the National Aeronautics and Space Administration Task Load Index (NASA-TLX), a survey composed of six subscales, designed to

assess perceived workload of NASA pilots. These subscales include mental demand, physical demand, temporal demand, frustration, effort, and performance as defined in the NASA-TLX Manuscript.[5] The NASA-TLX has been used broadly in aviation, the automotive industry, and more recently in medicine.[6-11]

Lower perceived workload, as measured by the NASA-TLX, has been linked to better performance in medicine.[10,11] Proper identification of a patient's illness severity may also be associated with improved clinician performance. Starmer and colleagues demonstrated a significant reduction in preventable adverse events after implementation of a tool that increased communication of patient illness severity during change-of-shift handoffs.[12]

Multidisciplinary rounds present a cognitive challenge: to integrate data, make diagnoses, prioritize care tasks, provide education, and to form shared mental models.[3,4] The magnitude of this challenge, however, has not been well defined~~, however~~. Also unclear are the differences in cognitive workload, if any, experienced by the different types of clinicians who participate in MDR. The current study sought to define the perceived workload associated with the completion of two important tasks during MDR: generating a personal assessment of overall patient condition and identifying the priorities ~~of~~ for the day's care plan.

Methods

We conducted this institutional review board approved survey study in three American Burn Association verified regional referral Burn ICUs. The NASA-TLX surveys were administered by research staff to clinicians at each site who participated in MDR during daily clinical practice according to the process outlined below.

Admission rates to these Burn ICUs varies from 270 to 300 patients per year with an average daily census between 2 (site 2) and 5 (site 1 and 3). At each site, MDR are led by an attending physician who was either a burn surgeon credentialed in critical care (sites 1, 2, and 3), or a medical intensivist with extensive burn experience (site 1). Nurse to patient ratios vary among sites from 1-to-1.5 nurses per patient at site 1, to 1 nurse per patient at sites 2 and 3. Attendance at MDR varies, but typically consists of the bedside nurse, rehabilitation specialists, registered dieticians, clinical pharmacists, respiratory therapists, burn fellows, residents, and students.

Multi-Disciplinary Rounds Conduct

MDR typically consisted of a resident presenting the patient by systems followed by other team members providing additional pertinent details and recommendations as they felt appropriate. The attending physician would direct the information flow and sequence of rounds as he felt necessary and would elicit from the team and/or state a care plan for the patient. Additionally, site 1 used a daily communication tool completed by the unit's "charge nurse" (e.g. nursing shift leader). This communication tool consists of a checklist that confirms use/absence of certain quality metrics (i.e. deep venous thrombosis prophylaxis, gastric ulcer prophylaxis, head-of-bed elevation, etc.) and a list of daily tasks that the charge nurse identified during rounds. At site 1, the charge nurse reviews the checklist and reads the identified tasks as the last activity of a patient's rounds prior to the MDR team moving on to the next patient.

Survey Administration:

Research staff administered the NASA-TLX as ~~a survey using~~ either a paper (sites 1 & 3) or electronic (site 2) ~~means~~ survey to a convenience sample of clinicians present on MDR for at least five discrete rounds events. A "discrete rounds event" was MDR rounds for a single patient. Thus, the NASA-TLX could be administered once per day for five days or five times in a single day for five different patients. Surveys were administered immediately after MDR was complete for a single ICU patient. Each site adjusted the survey collection period to meet the needs of their site and according to patient volume. Surveys were administered during different points in the MDR to account for physical and mental fatigue that may impact workload perception. For example, surveys were administered early in rounds (after the first patient), middle (after the middle patient) or late in rounds (after the last patient).

Prior to administration of the NASA-TLX survey, research staff reviewed a consent document with potential clinician subjects who participated in MDR. Clinicians were not required to participate, but their participation implied consent. Subjects were allowed to quit the study at any time by not completing the survey. Incomplete surveys were not included in the data analysis. Participation was anonymous and no personally identifying information or master list of participants was collected. We collected participant demographics including clinician type, years of experience, and time spent in direct care of the patient.

After the consent was reviewed and a copy provided to subjects, the research staff read directions aloud and then provided the NASA-TLX survey to participants. Time was provided for questions and clarification by the research staff. Clinicians assessed their workload associated with two tasks identified by the following questions: 1) "Identify if the patient is better, same or worse than yesterday" and 2) "Identify the most important objectives of care for the patient today."

Statistical Analysis

For the purpose of this study, we analyzed results according to the following groups: “physician” represents all attending physicians (burn surgeons or medical intensivists) who led or participated in MDR, as well as all physicians in training including those physicians who were part of a certified residency training program or fellowship; “nurse” represented all nurse types including licensed vocational nurses, registered nurses, and clinical nurse specialists; “student” represented medical students; and “other” represented clinicians not in any other category including respiratory therapists, dieticians, occupational or physical therapists, pharmacists, and psychiatry support personnel.

NASA-TLX Scores were calculated as described by Hart[5]: weighted cognitive load was calculated by first determining individual subscale ratings for mental demand, physical, temporal, performance, effort, and frustration, reported on a scale of 0-100 by asking subjects to place a mark on a line divided into 50 equal parts. A researcher then converted this analog representation into a value from 0-100. Individual subscales ratings were given a weighting factor which represented the perceived importance of a given subscale relative to the other subscales. This weight equaled the number of times a subject selected the subscale over another subscale while completing the “sources of workload” portion of the NASA-TLX survey. During this portion of the survey, subjects were asked to determine which subscales were the more important contributors to workload according to a series of 15 pair-wise comparisons. Thus, a weight could range from 0-5 (0 meaning that a subject never chose the subscale compared to other subscales and 5 meaning the subject always chose a subscale when comparing it to other subscales). Individual raw subscale data were multiplied by this weighting factor and were then summed. This sum was then divided by 15 to yield the weighted (total) cognitive workload.

The NASA-TLX survey scores were summarized using medians and interquartile ranges for each of the demographic groups. Due to the small sample size and lack of normality, the scores were analyzed using the nonparametric Wilcoxon's Test alone and with the Steel-Dwass method correction for multiple test correction.[13] Significance was established when the p-value was less than 0.05. All

analysis was performed using Statistical Analysis System (SAS) v9.2, SAS Institute Inc., Cary, USA or JMP v10.0, SAS Institute Inc., Cary, USA.

Results

Surveys were administered to a total of 119 clinicians across all sites; however three surveys were incomplete and were excluded from the analysis for a final n = 116. The median weighted cognitive load for task 1, identifying if a patient was better, same, or worse than the previous day (i.e. identifying the patient's "severity of illness" or SOI), was 40 (IQR 13-67). The median weighted cognitive load rating for task 2, identifying the most important objectives of care for the patient today (i.e. identifying the patient's "priorities of care" or POC) was 43 (IQR 18-68). Mental demand, temporal demand, performance, and effort all contributed more to the overall cognitive load than did physical demand or frustration subscales (table 1, figures 1-2). Perceived workload varied significantly according to clinician experience and professional background (figures 3-6), but not according to clinician location or time spent with the patient (data not shown). Interestingly, the frustration and physical demand subscales were particularly *non-normal* in their distribution across our sample. ~~40%~~ Forty percent of respondents reported no frustration and 63% of respondents reported no physical demand for identifying SOI. Numbers were similar for respondents' perception of frustration and physical demand for identifying POCs: 38% and 62% reported zero frustration or physical demand respectively.

Comparing perceived cognitive workload between clinician types revealed several significant differences ($p < 0.05$ for all comparisons, figures 3-4). Students, nurses, and physicians experienced a higher total cognitive workload than did "others" when identifying both SOI and POC. Students experienced more mental demand than "others" when identifying SOI and more than nurses and "others" when identifying POC. Nurses and physicians experienced more temporal demand than the "others" group when identifying SOI, while students, nurses, and physicians experienced more temporal

demand than “others” when identifying POC. Students also reported increased effort associated with identifying SOI as compared to all other groups, and more than physicians and “others” when identifying POC. Students perceived their performance to be worse than “others” when identifying SOI and nurses perceived it to be worse than “others” when identifying POC. Nurses and physicians perceived more frustration than~~t did~~ students and “others” when identifying SOI and more than others when identifying POC. Lastly, there were no significant differences between nurses and physicians for either task (figures 3 and 4).

It should be noted that the three largest groups, physicians (n=41), “other” providers (n=37), and nurses (n=25) had an ~~somewhat~~ unequal distribution of experience levels within their respective professional groups. The physician group included a large proportion (19 surveys , 46%) with <5 years of experience. The “others” group was largely composed of surveys of individuals with 5-10 years of experience (22 surveys, 59%). The nurses were similar to the physicians, in that a large proportion of those surveyed had <5 years of experience (14 surveys, 56%) (table 2).

Significant differences were also discovered when study participants were compared based upon their years of experience since graduation from licensing school (or year in school for students) ($P < 0.05$ for all comparisons, figures 5-6). Participants with 5-10 years of experience reported the least ~~about~~ amount of total cognitive work for both tasks compared to clinicians with <5 or >10 years of experience. Clinicians with > 10 years of perceived more total cognitive work for both tasks compared clinicians with 5-10 years of experience, but less than clinicians with < 5 years of experience. Finally, clinicians with < 5 years of experience perceived the most total cognitive work, which was significantly more than clinicians with > 4 years of experience.

When examining subscales that contribute to total cognitive work, the following observations were made: Clinicians with ~~more~~ < 5 years of experience perceived more metal demand than those with >4 years of experience when identifying SOI and more than clinicians with 5-10 years of experience

when identifying POC. Clinicians with < 5 years of experience perceived more temporal demand and felt their performance was worse for both tasks when compared to clinicians with 5-10 years of experience. Both tasks were perceived as requiring more effort for clinicians with < 5 years of experience compared to those with > 4 years of experience. Clinicians with 5-10 years of experience perceived significantly less frustration while identifying SOI than did those with < 5 and those with > 10 years of experience, but only less than those with > 10 years of experience when identifying POC. Finally, there was no apparent impact of experience on perceived physical demand. The largest differences in workload perception were consistently between those with < 5 years and those with 5-10 years of experience for all domains except frustration (see figures 5 and 6).

There were no significant differences in perceived total workload when comparing study sites or hours of direct patient care with respect to identifying either SOI or POC. However, there were differences between sites for some subscale domains. Site 3 clinicians perceived significantly more temporal demand than site 1 when identifying SOI (median 150 [IQR 90-210] vs. 60 [40-80], $p< 0.05$). Site 1 clinicians perceived significantly worse performance when identifying SOI than did clinicians at site 3 (median 140 [IQR 90-190] vs. 80 [IQR 40-120], $p < 0.05$). Clinicians at site 2 perceived significantly less frustration than clinicians at site 1 or site 3 for both tasks. Site 2 perceived no frustration when identifying SOI or POC, whereas clinicians at site 1 and site 3 perceived frustration as a relatively low contributor to ~~cognitive~~ workload when identifying SOI (site 1 & 2 frustration subscale score 20-30 [IQR 75% 0-120]) and when identifying POC (site 1 & 2 frustration subscale score 30 [IQR 75% 0-120]).

Discussions

This manuscript is the first to describe the cognitive work performed by clinicians during MDR in the Burn ICU. The NASA-TLX effectively revealed workload perception differences and similarities in cognitive work associated with completing two critical tasks performed during MDR: identifying a

patient's condition (severity of illness, SOI) and prioritizing associated treatments (priority of care, POC). Significant findings include:

1. Mental demand, temporal demand, performance, and effort were the primary determinants for the cognitive work performed for the identified tasks on MDR with mental demand being greatest;
2. students, nurses, and physicians all had higher perceived total workload for both SOI and POC than "others";
3. students perceived the most effort on rounds and had the most mental demand when identifying POC and significantly more than "others" when identifying SOI;
4. students, nurses, and physicians experienced significantly more temporal demand when identifying POC than ~~do~~ did "other" healthcare providers while only nurses and physicians perceived this significantly more than others for identifying SOI;
5. clinicians with the least experience ~~have~~ had higher perceived workload when identifying SOI and POC as compared to those with more experience;
6. and some individuals perceived more frustration and physical demand than most others during MDR.

Participation in MDR ~~is~~ was associated with ~~a~~ moderate cognitive workload for ~~the~~ nurses, physicians, students, and other healthcare professionals in attendance when completing two key tasks. Quantification of this workload with the NASA-TLX revealed unequal distribution of workload across the subscales of the task load index. Greater contributors to total load were mental demand, temporal demand, performance, and effort, with mental demand consistently the greatest for both tasks and compared to other subscales. Less substantial contributors were frustration, followed by physical demand. MDR is largely a thought exercise and so it ~~should~~ is not ~~be~~ surprising that participants reported relatively low physical demand. When taken as a whole, the MDR participants reported a low

cognitive workload associated with frustration, particularly at site 2. This low observed frustration level may be a reflection of how well the MDR participants are acclimated to the MDR process, experiencing relatively low levels of stress, annoyance, and irritation when participating in this well-practiced event or that site 2 clinicians work particularly well together, or have some other organizational culture/aspect (e.g. a lower census) that minimizes frustration. Also interesting was that the frustration and physical demand subscales demonstrated a significant right skew effect, driven by a large number of participants reporting little or no load associated with these 2 subscales. This was appreciated at site 2 also. This suggests that certain *individuals* may experience MDR differently than most others. In particular, some individuals perceive remarkably more frustration (figures 1-2).

This study was designed to be descriptive of cognitive workload associated with MDR. We did not seek to find significant ~~among~~ between group differences and yet such differences were found. Why do these differences exist and what impact do they have on patient care? We suspect that clinicians undergo a significant paradigm shift in their approach to medical decision making during the transition from novice to expert. A general stepwise paradigm of skill acquisition has been described previously, and applied to the healthcare setting in prior works.[14-16] ~~A later study~~ One study identified significant macro cognitive differences in the approach of a novice physician in the emergency department as compared to an expert. Junior physicians had difficulty integrating individual aspects of a patient presentation into a cogent picture. The same study showed that less experienced physicians had an overreliance on laboratory data and had difficulty integrating data that was inconsistent with their current diagnosis.[17] Furthermore, differences in professional background, especially those associated with increased specialization with career progression, promote differences in knowledge acquisition and information use that simplifies mental modeling, role based planning, and ultimately decreases cognitive work. These largely isolated professional development pathways may help explain how different healthcare provider types can have significantly different perceived cognitive workloads while

performing the same task under the same conditions. This was a phenomenon we observed when comparing nurses and physician workload to other, more specialized providers (e.g. respiratory therapists, rehabilitation specialist, wound care specialists, pharmacists, and dieticians). Interestingly, this compartmentalization, while helpful in easing cognitive workload may actually be counterproductive with regards to interprofessional communication and goal sharing on MDR.[18]

We identified that clinicians with <5 years of experience had an increased total cognitive workload as compared to more senior clinicians in both the 5-10 year and >10 year groups for both tasks. This difference was driven primarily by the effort and mental demand subscales. Our data affirm that the difficulties experienced by junior ED physicians extend to the ICU, where patients have complex presentations, often with significant pathology in multiple organ systems. Additionally, the ICU is data dense: clinicians must find, interpret, and include hundreds of data elements, some of which may be contradictory to each other, ~~form~~ from disparate sources such as vital signs monitors, laboratory reports, imaging studies, devices, other clinicians, protocols, knowledge bases.[19-20] Processing all of this data into an accurate assessment of SOI and determination of POC is a highly demanding task for the expert, let alone the novice. Limiting or simplifying these data inputs may be a way to decrease perceived cognitive workload for novice providers. Video projectors have been used successfully to make patient data available to MDR teams.[21] Such interventions may have a role in easing the burden of gleaning and recalling relevant data and allowing the novice to devote additional mental work to processing this data into important patient assessments.

Medical students are a group with arguably the least experience on the MDR team. They are operating in what is essentially a novel environment while involving themselves in the care of patients with complex pathophysiology. Students had a significantly higher level of workload as measured by the effort subscale when identifying SOI as compared to physicians with more experience. This

difference is not surprising as we might expect medical students to expend more cognitive effort in order to meaningfully participate in MDR.

Overall perceived total cognitive workload associated with identifying SOI and POC was similar when students, nurses, and physicians were compared. This total load reflected a weighted sum of all 6 NASA-TLX sub scores. These groups reported significantly higher workload for both tasks than the "others" group. This difference may be related to the cultural compartmentalization observed in individual healthcare professional communities, mentioned above. The difference may also be a reflection of differences in the duties and responsibilities commonly assumed by the different clinician types. These data should not be taken to mean the "other" providers on the MDR team contribute less because of their lower perceived workload; to the contrary, efforts should be made to achieve optimally low workloads for all MDR team members.

Increased temporal demand, particularly for nurses and physicians, may stem from a perceived need to see other patients, adhere to schedules, and perform other tasks both patient care related (e.g. family meetings, procedures, documentation) and administrative, educational, or research related (e.g. staff meetings, presentations, protocol development). Temporal demand was a particularly high contributor to total cognitive work at site 3, a busy academic and research oriented facility. Perhaps what goes on outside of MDR and/or away from the ICU drives this perceived increase in temporal demand. Limiting responsibilities outside of the ICU might improve perceived workload.

Interestingly, clinicians at site 1 had the lowest perceived temporal demand, ~~at site 1~~ but this was not associated with improved perception of performance with respect to identifying SOI. The importance of this finding is not clear as one might expect that less time pressure might improve perceived ~~importance~~ performance.

Another interesting trend was observed when examining perceived workload by years of experience. Those in the 5-10 year groups generally reported lower perceived workload than >10 year

groups. This phenomenon was evident in the mental demand, temporal demand, performance, effort, and frustration subscales observed for SOI, as well as the mental demand, temporal demand, ~~and~~ effort, and frustration subscales for POC. Examination of the composition of the experience groups by healthcare professional type revealed an uneven distribution of provider types across the experience groups. The 5-10 year group was composed of a disproportionately large number of "other" providers, as compared to the <5 and >10 years groups. Given that the "other" providers generally have a lower perceived workload as compared to the student, nurse, and physician groups, this differential helps to explain the observed trend. Certainly there may also be some inherent workload decrease in the 5-10 year group. This may represent a sort of cognitive apex effect, where professional development towards expertise is significant, frequency of task performance is optimal, and the clinician~~s~~ has the advantage of relative youth compared to more senior counterparts as Tsang has demonstrated.[22]

Other authors have shown that a higher cognitive workload, as measured with the NASA-TLX, is associated with increased error rates in medical practice.[10,11] This study identified relative inexperience as a factor associated with higher workload. We also identified medical students, nurses, and physicians as groups with relatively high associated cognitive workload. When taken together, this suggests that novice nurses and doctors may be at particularly high risk for committing mental errors associated with determination of SOI and POC. Incidentally these groups are responsible for providing much of the direct patient care within the ICU. Patient outcomes may be improved when providers are cognizant of an accurate assessment of the patients' illness severity.[12] A tool which provides these novice providers with an explicit assessment of patient SOI and by extension, the POC for management has the potential to reduce mental errors and improve outcomes in the ICU.[23]

These data are particularly valuable because they were collected at the time of the activity and, therefore, are less likely to be distorted by recall errors. Inter-center variability was examined and no significant differences were detected among study sites. This is consistent with the idea that the work

of MDR is not significantly affected by site specific factors. This speaks well to the external validity of the data generated.

This study had several important limitations. Data collection methods were not identical at each study center due to center-specific workflow differences. This may have introduced some confounding variability into the data set. We were not able to detect any significant inter-center workload differences; however, this study was not designed, and therefore not powered, to support such conclusions. The study was designed primarily to be descriptive of workload. Significant differences were discovered, as detailed above, but the failure to detect a significant difference cannot be taken to mean that such a difference does not exist. Another important limitation is that surveys were conducted on multiple occasions at each center over the course of a relatively short period of time. and, As a consequence, some providers were surveyed more than once. This resulted in an increased in number of data points entered into the analysis relative to the number of discrete survey takers. This may have resulted in an underestimation of variability within the study model.

In conclusion, this study provides insight into the workings of a complex MDR process in the ICU. We were able to identify groups within the MDR that experience higher workload as compared to others when completing two essential, yet often unspoken and unsupported, tasks. Furthermore, by describing the groups which experienced the highest perceived workload during MDR, we have identified the groups which stand to benefit the most from interventions targeted at decreasing the mental cognitive work associated with MDR. The study also serves as an affirmation that the NASA-TLX is an efficient tool which can be utilized in during a time focused pressured environment event like MDR. These findings support future works aimed at reducing perceived workload, as quantified with the NASA-TLX, during MDR in the Burn ICU.

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Figures Legends

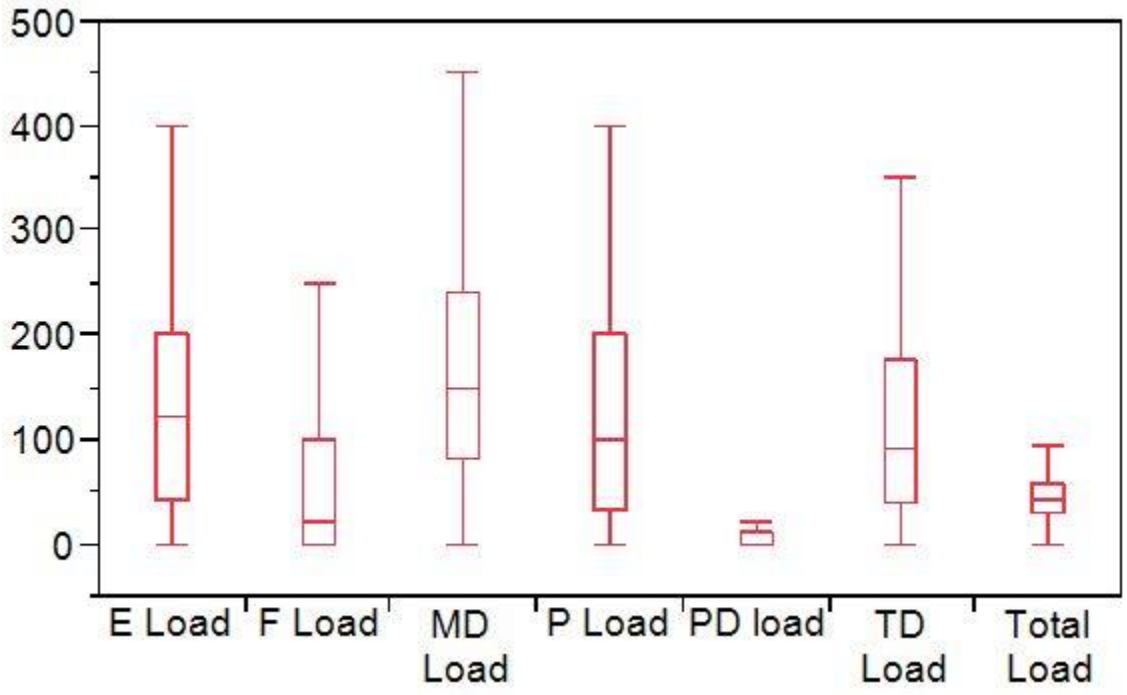


Figure 1. NASA-TLX subscale scores and total load for all survey takers for completion of task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), represented as median (line within box), inner quartile range (box), and range (capped lines). Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

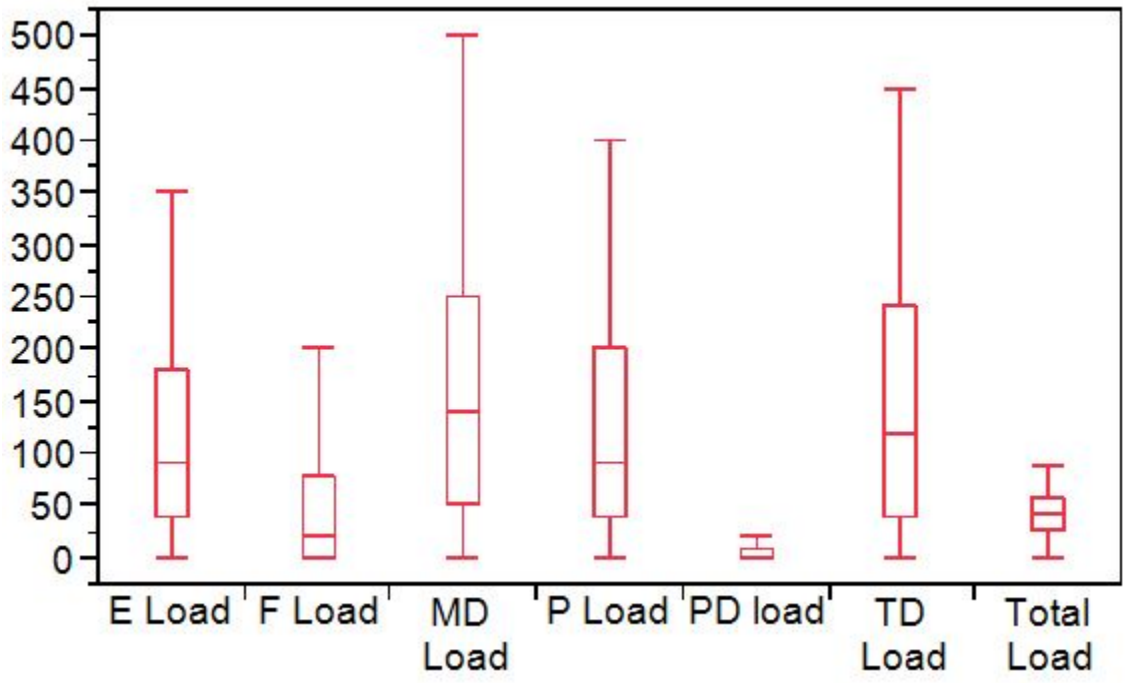
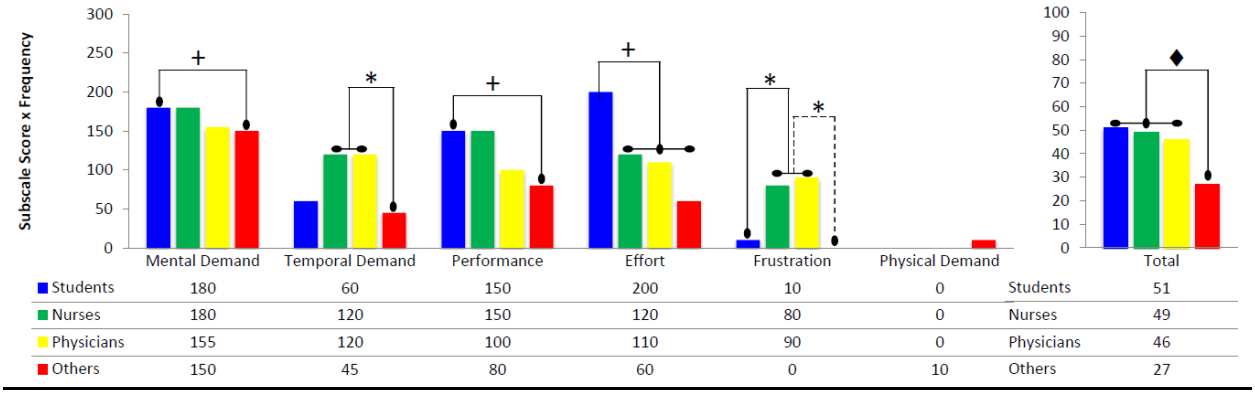


Figure 2. NASA-TLX subscale scores and total load for all survey takers for completion of task 2 ("Identify the priorities of care today" or POC), represented as median (line within box), inner quartile range (box), and range (capped lines). Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.



	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand		Total
Students	180	60	150	200	10	0	Students	51
Nurses	180	120	150	120	80	0	Nurses	49
Physicians	155	120	100	110	90	0	Physicians	46
Others	150	45	80	60	0	10	Others	27

Figure 3. Median values for the NASA-TLX subscales and overall workload for completing task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), as compared among clinician groups. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

♦ P < 0.05 by both methods

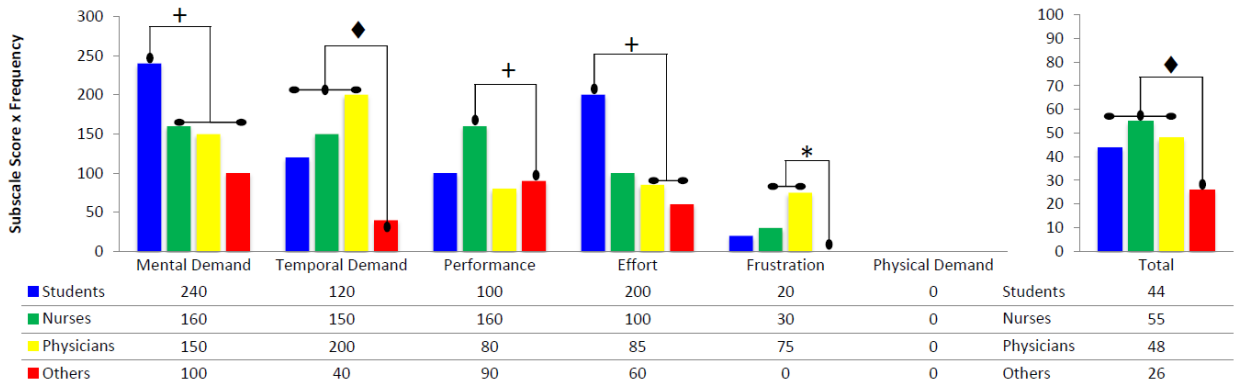


Figure 4. Median values for the NASA-TLX subscales and overall workload for completing task 2 ("Identify the priorities of care today" or POC), as compared among clinician groups. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of a the weighted subscale values divided by 15.

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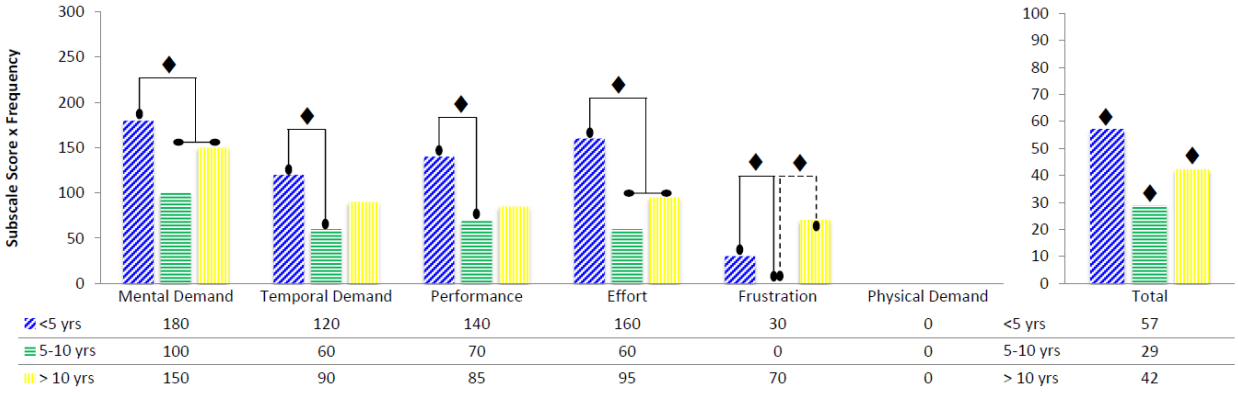

Figure 5. Median values for the NASA-TLX subscales and overall workload for completing task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), as compared among subgroups defined by years of experience. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

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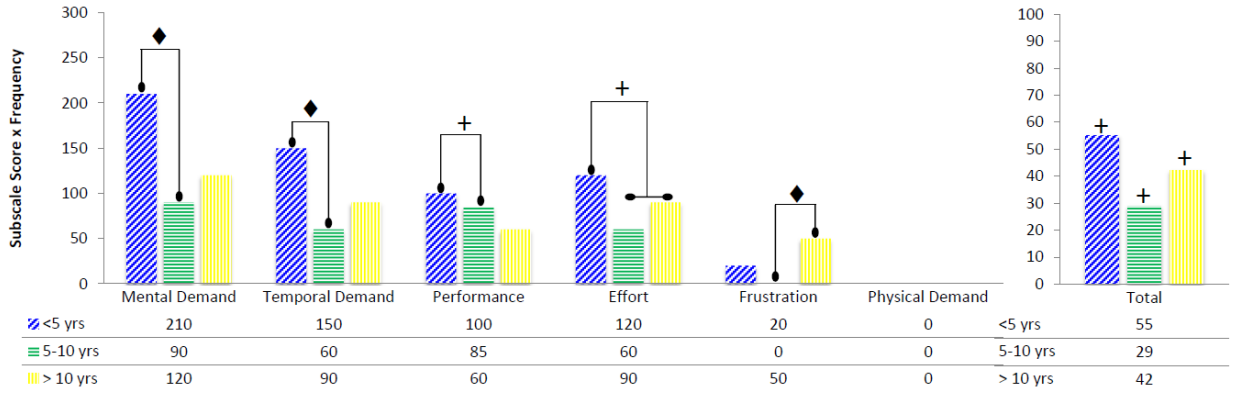

Figure 6. Median values for the NASA-TLX subscales and overall workload for completing task 2 ("Identify the priorities of care today" or POC), as compared among subgroups defined by years of experience. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

♦ *P < 0.05 by both methods*

Tables

Table 1. Demographic data for our convenience sample of clinicians participating in multidisciplinary rounds and willing to participate in this research describing the size, constitution, and years of experience since graduation from licensing school (or year in school for students) of the four subgroups of survey takers. *CN – charge nurse, CNS – clinical nurse specialist, HN – head nurse, OT – occupational therapist, RT – respiratory therapist.*

Group	n	Average Experience (range)	< 5 yrs	5-10 yrs	>10 yrs
Physician	**41**		**19**	**11**	**11**
Medical Intensivist	3	16.3 (10-27)	0	1	2
Burn Surgeon	11	11.8 (0-16)	~~22~~ 2	1	8
Resident	18	2.1 (0-13)	17	0	1
Fellow	9	5.9 (5-6)	0	9	0
Nurse	**25**		**14**	**5**	**6**
CN/CNS/HN	7	4.3 (0-12)	4	2	1
Nurse	18	8.9 (0-35)	10	3	5
Medical Student	**13**	**2.5 (0-4)**	**13**	**0**	**0**
Other Provider	**37**		**4**	**22**	**11**
Dietician	18	7.4 (5-10)	0	18	0
OT	1	1	1	0	0
Pharmacist	7	12.1 (2-24)	1	3	3
Psychiatry Support	1	13	0	0	1
RT	10	12.6 (4-25)	2	1	7
Total	**116**		**50**	**38**	**28**

Table 2. NASA-TLX subscale scores for all survey takers for completion of task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI) and task 2 ("Identify the priorities of care today" or POC), ranked by median subscale score. This constitutes a rank-order list describing subscale contributors to overall workload, denoted as "Total" below.

	Task 1: Severity of Illness		**Task 2: Priority of Care**	
Rank Order	**Subscale**	**Average Score (IQR)**	**Subscale**	**Average Score (IQR)**
1	Mental	150 (90-210)	Mental	120 (80-160)
2	Effort	120 (80-160)	Temporal	100 (60-140)
3	Performance	100 (60-140)	Performance	90 (50-130)
4	Temporal	90 (50-130)	Effort	90 (50-130)
5	Frustration	20 (20-20)	Frustration	20 (20-20)
6	Physical	0 (0-0)	Physical	0 (0-0)
Total	**40 (13-67)**		**43 (18-68)**	

Figure 1

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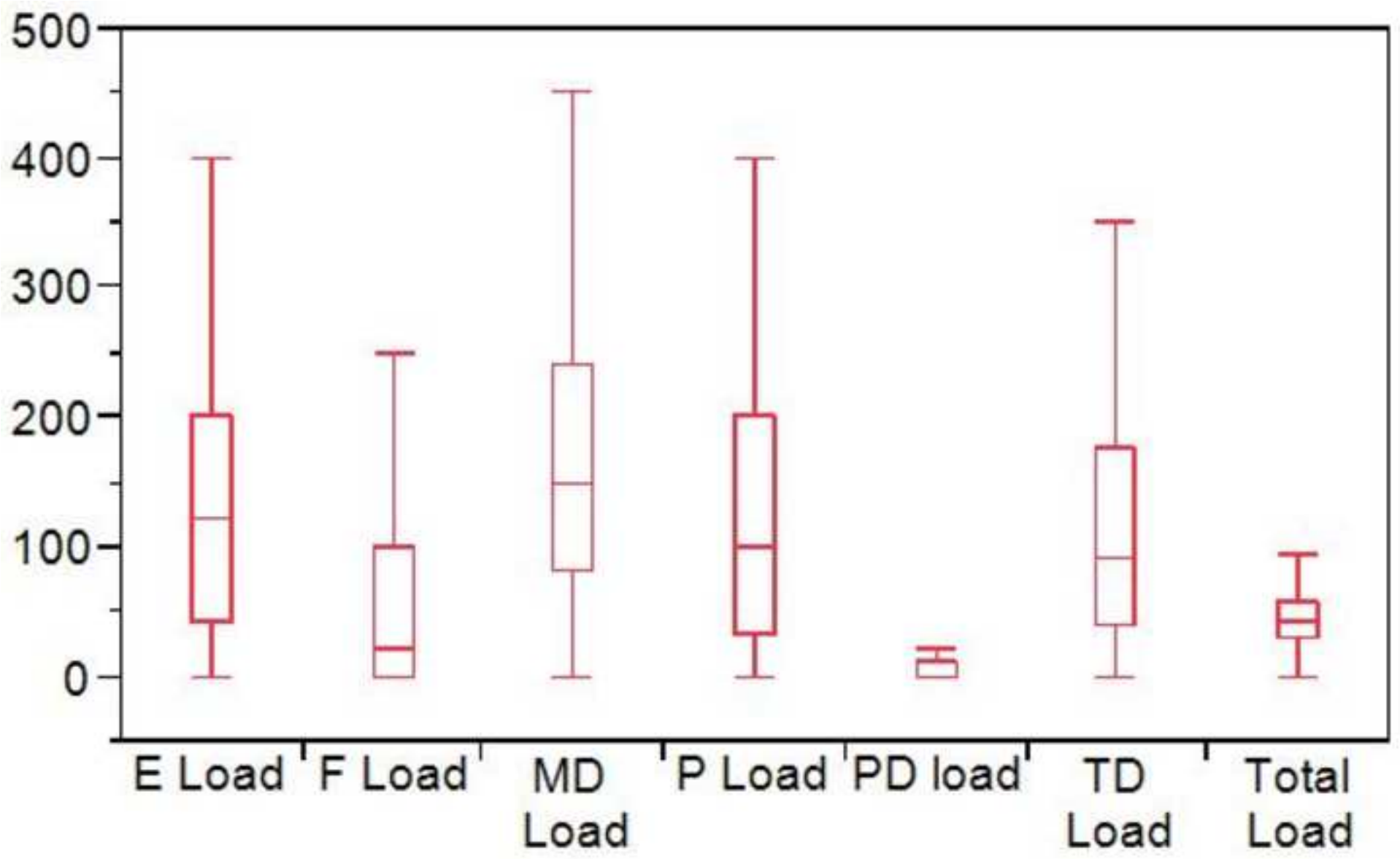

Figure 2

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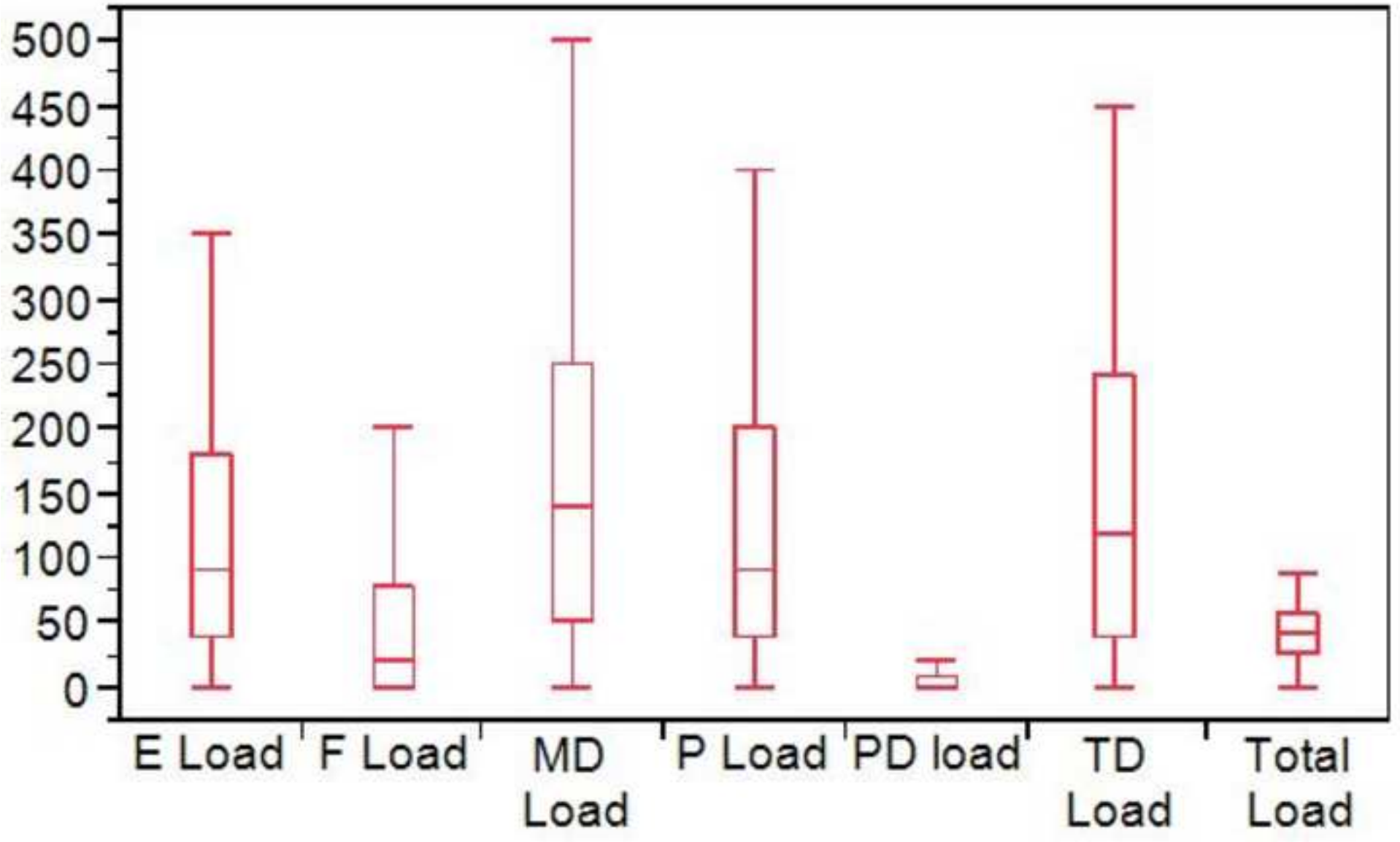

Figure 3

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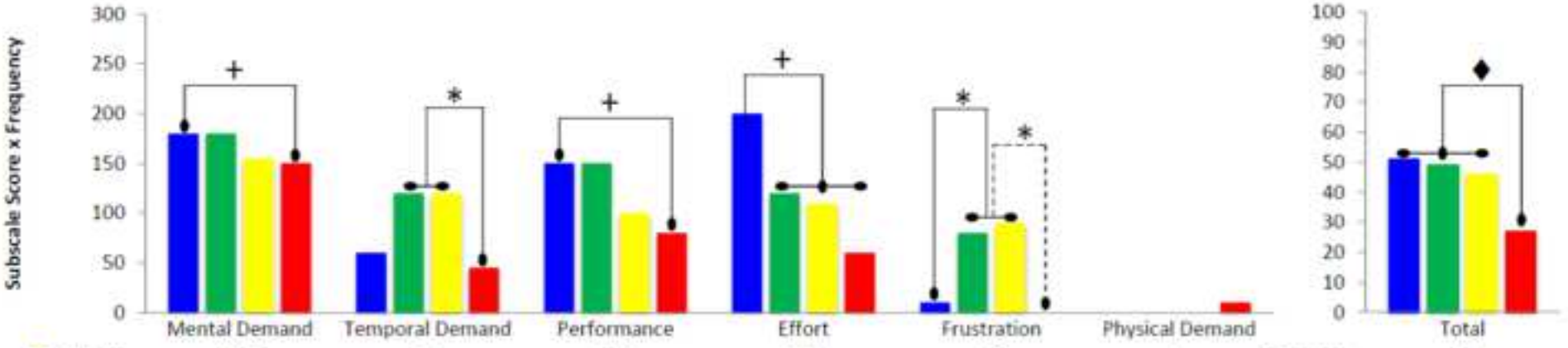

	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand		Total
Students	180	60	150	200	10	0	Students	51
Nurses	180	120	150	120	80	0	Nurses	49
Physicians	155	120	100	110	90	0	Physicians	46
Others	150	45	80	60	0	10	Others	27

Figure 4

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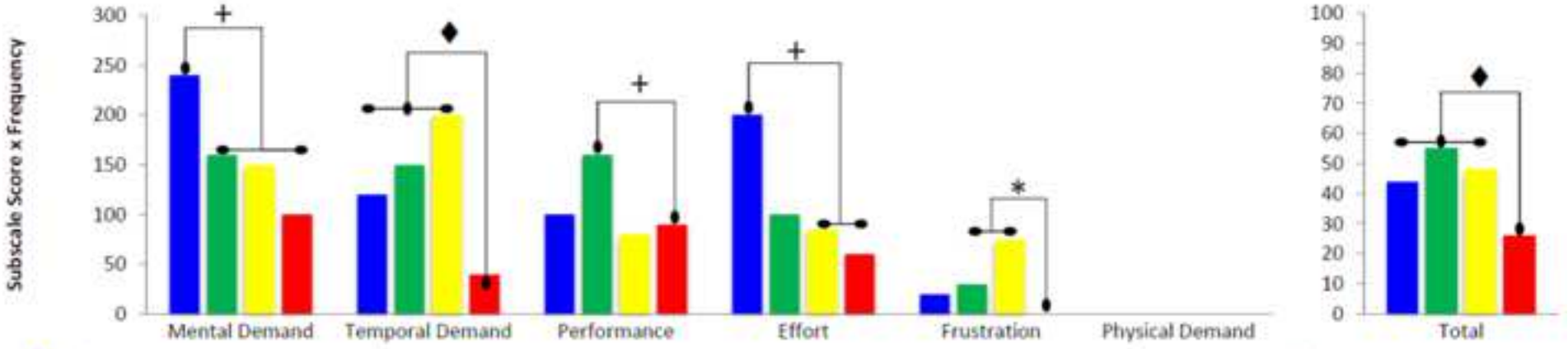

	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand		Total
Students	240	120	100	200	20	0	Students	44
Nurses	160	150	160	100	30	0	Nurses	55
Physicians	150	200	80	85	75	0	Physicians	48
Others	100	40	90	60	0	0	Others	26

Figure 5

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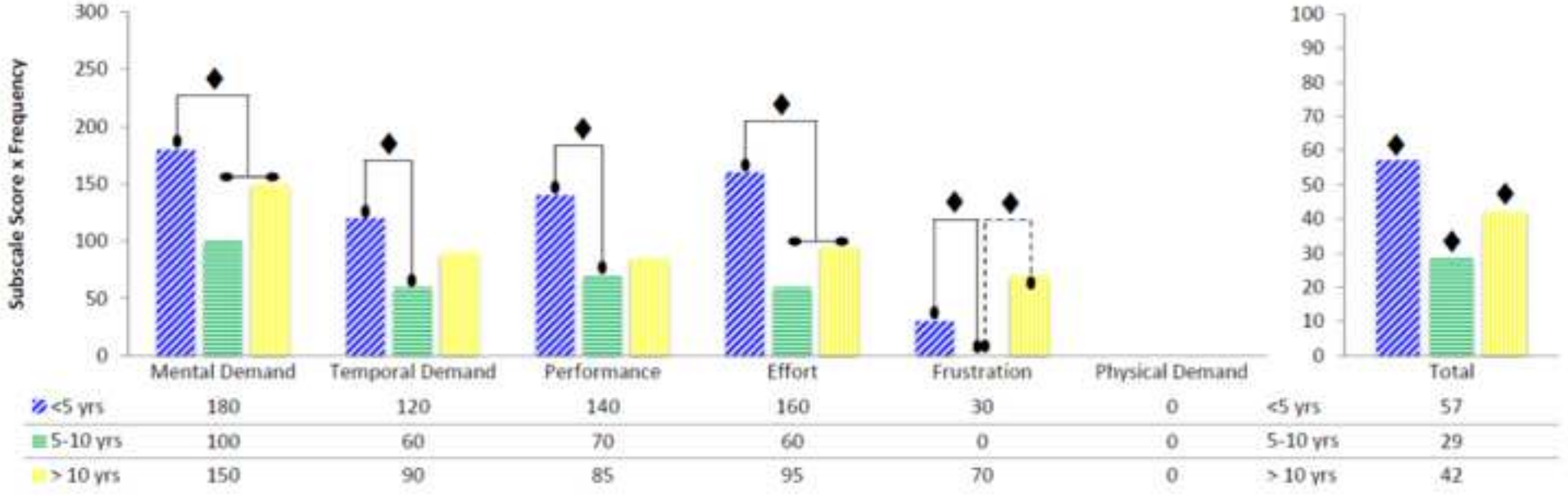

	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand		Total
<5 yrs	180	120	140	160	30	0	<5 yrs	57
5-10 yrs	100	60	70	60	0	0	5-10 yrs	29
> 10 yrs	150	90	85	95	70	0	> 10 yrs	42

Figure 6

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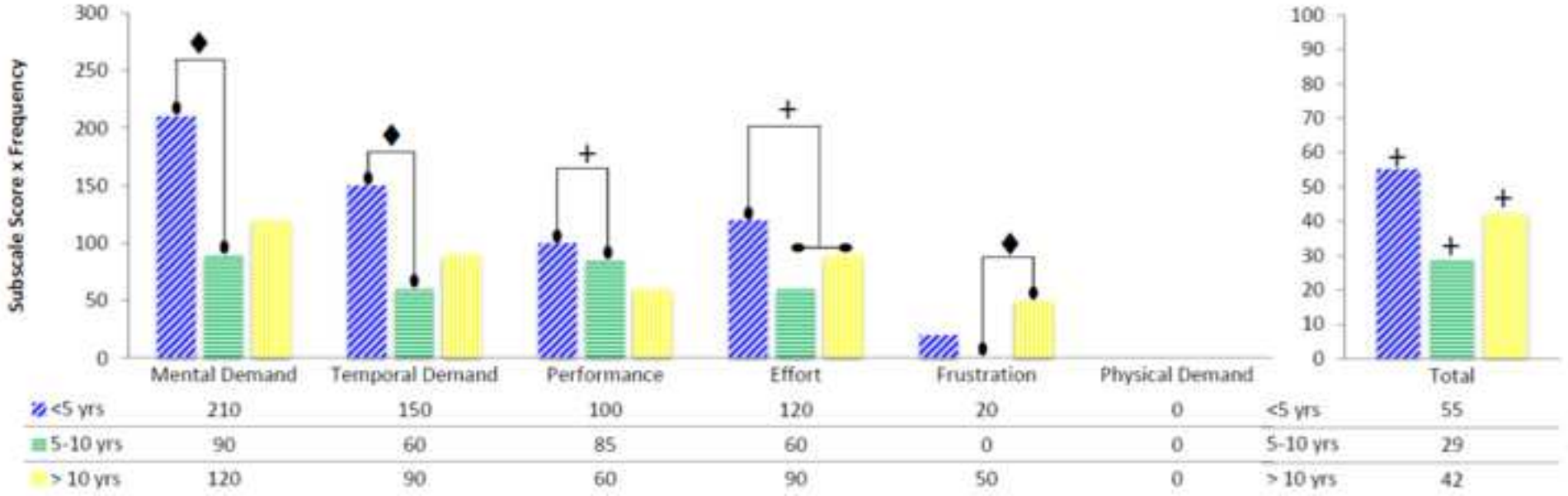

	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand
<5 yrs	210	150	100	120	20	0
5-10 yrs	90	60	85	60	0	0
> 10 yrs	120	90	60	90	50	0

	Total
<5 yrs	55
5-10 yrs	29
> 10 yrs	42

Title: Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs.

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Disclosure: This study was conducted under a protocol reviewed and approved by the Brooke Army Medical Center Institutional Review Board and in accordance with the approved protocol. The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Title: Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs.

Abstract

Introduction:

Multidisciplinary rounds (MDR) in the Burn Intensive Care Unit serve as an efficient means for clinicians to assess patient status and establish patient care priorities. Both tasks require significant cognitive work, the magnitude of which is relevant because increased cognitive work of task completion has been associated with increased error rates. We sought to quantify this workload during MDR using the National Aeronautics and Space Administration Task Load Index (NASA-TLX).

Methods:

Research staff at 3 academic regional referral burn centers administered the NASA-TLX to clinicians during MDR. Clinicians assessed their workload associated with 1) "Identify[ing] if the patient is better, same, or worse than yesterday" and 2) "Identify[ing] the most important objectives of care for the patient today." Data were collected on clinician type, years of experience, and hours of direct patient care.

Results:

Surveys were administered to 116 total clinicians, 41 physicians, 25 nurses, 13 medical students and 37 clinicians in other roles. Clinicians with less experience reported more cognitive work when completing both tasks ($p<.005$). Clinicians in the "others" group (respiratory therapists, dieticians, pharmacists, etc.) reported less cognitive work than all other groups for both tasks ($p<0.05$).

Conclusions:

The NASA-TLX was an effective tool for collecting perceptions of cognitive workload associated with MDR. Perceived cognitive work varied by clinician type and experience level when completing 2 key tasks. Less experience was associated with increased perceived work, potentially increasing metal error rates and increasing risk to patients. Creating tools or work processes to reduce cognitive work may improve clinician performance.

Key Words

1. Teaching Rounds
2. Intensive Care
3. Cognitive Work
4. Task Performance and Analysis

Introduction

The burn intensive care unit (ICU) presents a challenging work environment to the healthcare team. Effective care requires the coordinated effort of healthcare professionals from different backgrounds, each member contributing unique perspective toward a common goal. These teams are a necessity given the complexity of managing the medical, administrative, and social aspects of patient care. Multidisciplinary rounds (MDR) is an event that facilitates communication of relevant information among team members and is associated with better outcomes in the ICU.[1,2,3]

While MDR represent a powerful tool and a logical means for efficient dissemination of information, there is variability in the quality and effectiveness of such rounds. MDR must encompass key aspects of care, to include problems, plans, and goals. The multidisciplinary team must be effectively *managed* to ensure that all important aspects of patient care are addressed. Caution must also be taken to ensure that information is discussed clearly and in such a way that it is accessible to all members of the team who need it; thus, helping to avoid the need for inefficient clarifications with individual team members after MDR have ended.[4] Input from all team members must be evaluated and integrated by the team leader, typically a physician, in such a way as to create a cohesive, prioritized care plan.[2]

A series of decisions are made during MDR, some critical, some routine. Likewise the cognitive work that goes into making these decisions is variable. In the same way that physical work is defined in terms of distance and force, cognitive work can be imagined as a function of a task and the perceived effort required to complete it. Different people have different perceived workloads when completing the same task according to their familiarity with the task and their overall experience with the task or similar tasks.[5] Calculating workload by this definition requires quantification of perceived mental "force." Hart and Staveland developed the National Aeronautics and Space Administration Task Load Index (NASA-TLX), a survey composed of six subscales, designed to assess perceived workload of NASA

pilots. These subscales include mental demand, physical demand, temporal demand, frustration, effort, and performance as defined in the NASA-TLX Manuscript.[5] The NASA-TLX has been used broadly in aviation, the automotive industry, and more recently in medicine.[6-11]

Lower perceived workload, as measured by the NASA-TLX, has been linked to better performance in medicine.[10,11] Proper identification of a patient's illness severity may also be associated with improved clinician performance. Starmer and colleagues demonstrated a significant reduction in preventable adverse events after implementation of a tool that increased communication of patient illness severity during change-of-shift handoffs.[12]

Multidisciplinary rounds present a cognitive challenge: to integrate data, make diagnoses, prioritize care tasks, provide education, and to form shared mental models.[3,4] The magnitude of this challenge, however, has not been well defined. Also unclear are the differences in cognitive workload, if any, experienced by the different types of clinicians who participate in MDR. The current study sought to define the perceived workload associated with the completion of two important tasks during MDR: generating a personal assessment of overall patient condition and identifying the priorities for the day's care plan.

Methods

We conducted this institutional review board approved survey study in three American Burn Association verified regional referral Burn ICUs. The NASA-TLX surveys were administered by research staff to clinicians at each site who participated in MDR during daily clinical practice according to the process outlined below.

Admission rates to these Burn ICUs varies from 270 to 300 patients per year with an average daily census between 2 (site 2) and 5 (site 1 and 3). At each site, MDR are led by an attending physician who was either a burn surgeon credentialed in critical care (sites 1, 2, and 3), or a medical intensivist with extensive burn experience (site 1). Nurse to patient ratios vary among sites from 1-to-1.5 nurses per patient at site 1, to 1 nurse per patient at sites 2 and 3. Attendance at MDR varies, but typically consists of the bedside nurse, rehabilitation specialists, registered dieticians, clinical pharmacists, respiratory therapists, burn fellows, residents, and students.

Multi-Disciplinary Rounds Conduct

MDR typically consisted of a resident presenting the patient by systems followed by other team members providing additional pertinent details and recommendations as they felt appropriate. The attending physician would direct the information flow and sequence of rounds as he felt necessary and would elicit from the team and/or state a care plan for the patient. Additionally, site 1 used a daily communication tool completed by the unit's "charge nurse" (e.g. nursing shift leader). This communication tool consists of a checklist that confirms use/absence of certain quality metrics (i.e. deep venous thrombosis prophylaxis, gastric ulcer prophylaxis, head-of-bed elevation, etc.) and a list of daily tasks that the charge nurse identified during rounds. At site 1, the charge nurse reviews the checklist and reads the identified tasks as the last activity of a patient's rounds prior to the MDR team moving on to the next patient.

Survey Administration:

Research staff administered the NASA-TLX as either a paper (sites 1 & 3) or electronic (site 2) survey to a convenience sample of clinicians present on MDR for at least five discrete rounds events. A "discrete rounds event" was MDR rounds for a single patient. Thus, the NASA-TLX could be administered once per day for five days or five times in a single day for five different patients. Surveys were administered immediately after MDR was complete for a single ICU patient. Each site adjusted the survey collection period to meet the needs of their site and according to patient volume. Surveys were administered during different points in the MDR to account for physical and mental fatigue that may impact workload perception. For example, surveys were administered early in rounds (after the first patient), middle (after the middle patient) or late in rounds (after the last patient).

Prior to administration of the NASA-TLX survey, research staff reviewed a consent document with potential clinician subjects who participated in MDR. Clinicians were not required to participate, but their participation implied consent. Subjects were allowed to quit the study at any time by not completing the survey. Incomplete surveys were not included in the data analysis. Participation was anonymous and no personally identifying information or master list of participants was collected. We collected participant demographics including clinician type, years of experience, and time spent in direct care of the patient.

After the consent was reviewed and a copy provided to subjects, the research staff read directions aloud and then provided the NASA-TLX survey to participants. Time was provided for questions and clarification by the research staff. Clinicians assessed their workload associated with two tasks identified by the following questions: 1) "Identify if the patient is better, same or worse than yesterday" and 2) "Identify the most important objectives of care for the patient today."

Statistical Analysis

For the purpose of this study, we analyzed results according to the following groups: “physician” represents all attending physicians (burn surgeons or medical intensivists) who led or participated in MDR, as well as all physicians in training including those physicians who were part of a certified residency training program or fellowship; “nurse” represented all nurse types including licensed vocational nurses, registered nurses, and clinical nurse specialists; “student” represented medical students; and “other” represented clinicians not in any other category including respiratory therapists, dieticians, occupational or physical therapists, pharmacists, and psychiatry support personnel.

NASA-TLX Scores were calculated as described by Hart[5]: weighted cognitive load was calculated by first determining individual subscale ratings for mental demand, physical, temporal, performance, effort, and frustration~~,~~ reported on a scale of 0-100 by asking subjects to place a mark on a line divided into 50 equal parts. A researcher then converted this analog representation into a value from 0-100. Individual subscales ratings were given a weighting factor which represented the perceived importance of a given subscale relative to the other subscales. This weight equaled the number of times a subject selected the subscale over another subscale while completing the “sources of workload” portion of the NASA-TLX survey. During this portion of the survey, subjects were asked to determine which subscales were the more important contributors to workload according to a series of 15 pair-wise comparisons. Thus, a weight could range from 0-5 (0 meaning that a subject never chose the subscale compared to other subscales and 5 meaning the subject always chose a subscale when comparing it to other subscales). Individual raw subscale data were multiplied by this weighting factor and were then summed. This sum was then divided by 15 to yield the weighted (total) workload.

The NASA-TLX survey scores were summarized using medians and interquartile ranges for each of the demographic groups. Due to the small sample size and lack of normality, the scores were analyzed using the nonparametric Wilcoxon's Test with the Steel-Dwass correction for multiple test correction.[13] Significance was established when the p-value was less than 0.05. All analysis was

performed using Statistical Analysis System (SAS) v9.2, SAS Institute Inc., Cary, USA or JMP v10.0, SAS Institute Inc., Cary, USA.

Results

Surveys were administered to a total of 119 clinicians across all sites; however three surveys were incomplete and were excluded from the analysis for a final n = 116. The median weighted cognitive load for task 1, identifying if a patient was better, same, or worse than the previous day (i.e. identifying the patient's "severity of illness" or SOI), was 40 (IQR 13-67). The median weighted cognitive load rating for task 2, identifying the most important objectives of care for the patient today (i.e. identifying the patient's "priorities of care" or POC) was 43 (IQR 18-68). Mental demand, temporal demand, performance, and effort all contributed more to the overall cognitive load than did physical demand or frustration subscales (table 1, figures 1-2). Perceived workload varied significantly according to clinician experience and professional background (figures 3-6), but not according to clinician location or time spent with the patient (data not shown). Interestingly, the frustration and physical demand subscales were particularly *non-normal* in their distribution across our sample. Forty percent of respondents reported no frustration and 63% of respondents reported no physical demand for identifying SOI. Numbers were similar for respondents' perception of frustration and physical demand for identifying POCs: 38% and 62% reported zero frustration or physical demand respectively.

Comparing perceived cognitive workload between clinician types revealed several significant differences ($p < 0.05$ for all comparisons, figures 3-4). Students, nurses, and physicians experienced a higher total cognitive workload than did "others" when identifying both SOI and POC. Students experienced more mental demand than "others" when identifying SOI and more than nurses and "others" when identifying POC. Nurses and physicians experienced more temporal demand than the "others" group when identifying SOI, while students, nurses, and physicians experienced more temporal

demand than “others” when identifying POC. Students also reported increased effort associated with identifying SOI as compared to all other groups, and more than physicians and “others” when identifying POC. Students perceived their performance to be worse than “others” when identifying SOI and nurses perceived it to be worse than “others” when identifying POC. Nurses and physicians perceived more frustration than students and “others” when identifying SOI and more than others when identifying POC. Lastly, there were no significant differences between nurses and physicians for either task (figures 3 and 4).

It should be noted that the three largest groups, physicians (n=41), “other” providers (n=37), and nurses (n=25) had an unequal distribution of experience levels within their respective professional groups. The physician group included a large proportion (19 surveys , 46%) with <5 years of experience. The “others” group was largely composed of surveys of individuals with 5-10 years of experience (22 surveys, 59%). The nurses were similar to the physicians, in that a large proportion of those surveyed had <5 years of experience (14 surveys, 56%) (table 2).

Significant differences were also discovered when study participants were compared based upon their years of experience since graduation from licensing school (or year in school for students) ($P < 0.05$ for all comparisons, figures 5-6). Participants with 5-10 years of experience reported the least amount of total cognitive work for both tasks compared to clinicians with <5 or >10 years of experience. Clinicians with > 10 years of perceived more total cognitive work for both tasks compared clinicians with 5-10 years of experience, but less than clinicians with < 5 years of experience. Finally, clinicians with < 5 years of experience perceived the most total cognitive work, which was significantly more than clinicians with > 4 years of experience.

When examining subscales that contribute to total cognitive work, the following observations were made: Clinicians with < 5 years of experience perceived more metal demand than those with >4 years of experience when identifying SOI and more than clinicians with 5-10 years of experience when

identifying POC. Clinicians with < 5 years of experience perceived more temporal demand and felt their performance was worse for both tasks when compared to clinicians with 5-10 years of experience. Both tasks were perceived as requiring more effort for clinicians with < 5 years of experience compared to those with > 4 years of experience. Clinicians with 5-10 years of experience perceived significantly less frustration while identifying SOI than did those with < 5 and those with > 10 years of experience, but only less than those with > 10 years of experience when identifying POC. Finally, there was no apparent impact of experience on perceived physical demand. The largest differences in workload perception were consistently between those with < 5 years and those with 5-10 years of experience for all domains except frustration (see figures 5 and 6).

There were no significant differences in perceived total workload when comparing study sites or hours of direct patient care with respect to identifying either SOI or POC. However, there were differences between sites for some subscale domains. Site 3 clinicians perceived significantly more temporal demand than site 1 when identifying SOI (median 150 [IQR 90-210] vs. 60 [40-80], $p< 0.05$). Site 1 clinicians perceived significantly worse performance when identifying SOI than did clinicians at site 3 (median 140 [IQR 90-190] vs. 80 [IQR 40-120], $p < 0.05$). Clinicians at site 2 perceived significantly less frustration than clinicians at site 1 or site 3 for both tasks. Site 2 perceived no frustration when identifying SOI or POC, whereas clinicians at site 1 and site 3 perceived frustration as a relatively low contributor to workload when identifying SOI (site 1 & 2 frustration subscale score 20-30 [IQR 75% 0-120]) and when identifying POC (site 1 & 2 frustration subscale score 30 [IQR 75% 0-120]).

Discussions

This manuscript is the first to describe the cognitive work performed by clinicians during MDR in the Burn ICU. The NASA-TLX effectively revealed workload perception differences and similarities in cognitive work associated with completing two critical tasks performed during MDR: identifying a

patient's condition (severity of illness, SOI) and prioritizing associated treatments (priority of care, POC). Significant findings include:

1. Mental demand, temporal demand, performance, and effort were the primary determinants for the cognitive work performed for the identified tasks on MDR with mental demand being greatest;
2. students, nurses, and physicians all had higher perceived total workload for both SOI and POC than "others";
3. students perceived the most effort on rounds and had the most mental demand when identifying POC and significantly more than "others" when identifying SOI;
4. students, nurses, and physicians experienced significantly more temporal demand when identifying POC than did "other" healthcare providers while only nurses and physicians perceived this significantly more than others for identifying SOI;
5. clinicians with the least experience had higher perceived workload when identifying SOI and POC as compared to those with more experience;
6. and some individuals perceived more frustration and physical demand than most others during MDR.

Participation in MDR ~~is~~ was associated with ~~a~~ moderate cognitive workload for nurses, physicians, students, and other healthcare professionals in attendance when completing two key tasks. Quantification of this workload with the NASA-TLX revealed unequal distribution of workload across the subscales of the task load index. Greater contributors to total load were mental demand, temporal demand, performance, and effort, with mental demand consistently the greatest for both tasks and compared to other subscales. Less substantial contributors were frustration, followed by physical demand. MDR is largely a thought exercise and so it is not surprising that participants reported relatively low physical demand. When taken as a whole, the MDR participants reported a low cognitive

workload associated with frustration, particularly at site 2. This low observed frustration level may be a reflection of how well the MDR participants are acclimated to the MDR process, experiencing relatively low levels of stress, annoyance, and irritation when participating in this well-practiced event or that site 2 clinicians work particularly well together, or have some other organizational culture/aspect (e.g. a lower census) that minimizes frustration. Also interesting was that the frustration and physical demand subscales demonstrated a significant right skew effect, driven by a large number of participants reporting little or no load associated with these 2 subscales. This was appreciated at site 2 also. This suggests that certain *individuals* may experience MDR differently than most others. In particular, some individuals perceive remarkably more frustration (figures 1-2).

This study was designed to be descriptive of cognitive workload associated with MDR. We did not seek to find significant between group differences and yet such differences were found. Why do these differences exist and what impact do they have on patient care? We suspect that clinicians undergo a significant paradigm shift in their approach to medical decision making during the transition from novice to expert. A general stepwise paradigm of skill acquisition has been described previously, and applied to the healthcare setting in prior works.[14-16] One study identified significant macro cognitive differences in the approach of a novice physician in the emergency department as compared to an expert. Junior physicians had difficulty integrating individual aspects of a patient presentation into a cogent picture. The same study showed that less experienced physicians had an overreliance on laboratory data and had difficulty integrating data that was inconsistent with their current diagnosis.[17] Furthermore, differences in professional background, especially those associated with increased specialization with career progression, promote differences in knowledge acquisition and information use that simplifies mental modeling, role based planning, and ultimately decreases cognitive work. These largely isolated professional development pathways may help explain how different healthcare provider types can have significantly different perceived cognitive workloads while performing the same

task under the same conditions. This was a phenomenon we observed when comparing nurses and physician workload to other, more specialized providers (e.g. respiratory therapists, rehabilitation specialist, wound care specialists, pharmacists, and dieticians). Interestingly, this compartmentalization, while helpful in easing cognitive workload may actually be counterproductive with regards to interprofessional communication and goal sharing on MDR.[18]

We identified that clinicians with <5 years of experience had an increased total cognitive workload as compared to more senior clinicians in both the 5-10 year and >10 year groups for both tasks. This difference was driven primarily by the effort and mental demand subscales. Our data affirm that the difficulties experienced by junior ED physicians extend to the ICU, where patients have complex presentations, often with significant pathology in multiple organ systems. Additionally, the ICU is data dense: clinicians must find, interpret, and include hundreds of data elements, some of which may be contradictory to each other, from disparate sources such as vital signs monitors, laboratory reports, imaging studies, devices, other clinicians, protocols, knowledge bases.[19-20] Processing all of this data into an accurate assessment of SOI and determination of POC is a highly demanding task for the expert, let alone the novice. Limiting or simplifying these data inputs may be a way to decrease perceived cognitive workload for novice providers. Video projectors have been used successfully to make patient data available to MDR teams.[21] Such interventions may have a role in easing the burden of gleaning and recalling relevant data and allowing the novice to devote additional mental work to processing this data into important patient assessments.

Medical students are a group with arguably the least experience on the MDR team. They are operating in what is essentially a novel environment while involving themselves in the care of patients with complex pathophysiology. Students had a significantly higher level of workload as measured by the effort subscale when identifying SOI as compared to physicians with more experience. This

difference is not surprising as we might expect medical students to expend more cognitive effort in order to meaningfully participate in MDR.

Overall perceived total cognitive workload associated with identifying SOI and POC was similar when students, nurses, and physicians were compared. This total load reflected a weighted sum of all 6 NASA-TLX sub scores. These groups reported significantly higher workload for both tasks than the "others" group. This difference may be related to the cultural compartmentalization observed in individual healthcare professional communities, mentioned above. The difference may also be a reflection of differences in the duties and responsibilities commonly assumed by the different clinician types. These data should not be taken to mean the "other" providers on the MDR team contribute less because of their lower perceived workload; to the contrary, efforts should be made to achieve optimally low workloads for all MDR team members.

Increased temporal demand, particularly for nurses and physicians, may stem from a perceived need to see other patients, adhere to schedules, and perform other tasks both patient care related (e.g. family meetings, procedures, documentation) and administrative, educational, or research related (e.g. staff meetings, presentations, protocol development). Temporal demand was a particularly high contributor to total cognitive work at site 3, a busy academic and research oriented facility. Perhaps what goes on outside of MDR and/or away from the ICU drives this perceived increase in temporal demand. Limiting responsibilities outside of the ICU might improve perceived workload.

Interestingly, clinicians at site 1 had the lowest perceived temporal demand, but this was not associated with improved perception of performance with respect to identifying SOI. The importance of this finding is not clear as one might expect that less time pressure might improve perceived performance.

Another interesting trend was observed when examining perceived workload by years of experience. Those in the 5-10 year groups generally reported lower perceived workload than >10 year

groups. This phenomenon was evident in the mental demand, temporal demand, performance, effort, and frustration subscales observed for SOI, as well as the mental demand, temporal demand, ~~and~~ effort, and frustration subscales for POC. Examination of the composition of the experience groups by healthcare professional type revealed an uneven distribution of provider types across the experience groups. The 5-10 year group was composed of a disproportionately large number of "other" providers, as compared to the <5 and >10 years groups. Given that the "other" providers generally have a lower perceived workload as compared to the student, nurse, and physician groups, this differential helps to explain the observed trend. Certainly there may also be some inherent workload decrease in the 5-10 year group. This may represent a sort of cognitive apex effect, where professional development towards expertise is significant, frequency of task performance is optimal, and the clinician has the advantage of relative youth compared to more senior counterparts as Tsang has demonstrated.[22]

Other authors have shown that a higher cognitive workload, as measured with the NASA-TLX, is associated with increased error rates in medical practice.[10,11] This study identified relative inexperience as a factor associated with higher workload. We also identified medical students, nurses, and physicians as groups with relatively high associated cognitive workload. When taken together, this suggests that novice nurses and doctors may be at particularly high risk for committing mental errors associated with determination of SOI and POC. Incidentally these groups are responsible for providing much of the direct patient care within the ICU. Patient outcomes may be improved when providers are cognizant of an accurate assessment of the patients' illness severity.[12] A tool which provides these novice providers with an explicit assessment of patient SOI and by extension, the POC for management has the potential to reduce mental errors and improve outcomes in the ICU.[23]

These data are particularly valuable because they were collected at the time of the activity and, therefore, are less likely to be distorted by recall errors. Inter-center variability was examined and no significant differences were detected among study sites. This is consistent with the idea that the work

of MDR is not significantly affected by site specific factors. This speaks well to the external validity of the data generated.

This study had several important limitations. Data collection methods were not identical at each study center due to center-specific workflow differences. This may have introduced some confounding variability into the data set. We were not able to detect any significant inter-center workload differences; however, this study was not designed, and therefore not powered, to support such conclusions. The study was designed primarily to be descriptive of workload. Significant differences were discovered, as detailed above, but the failure to detect a significant difference cannot be taken to mean that such a difference does not exist. Another important limitation is that surveys were conducted on multiple occasions at each center over the course of a relatively short period of time. As a consequence, some providers were surveyed more than once. This resulted in an increased number of data points entered into the analysis relative to the number of discrete survey takers. This may have resulted in an underestimation of variability within the study model.

In conclusion, this study provides insight into the workings of a complex MDR process in the ICU. We were able to identify groups within the MDR that experience higher workload as compared to others when completing two essential, yet often unspoken and unsupported, tasks. Furthermore, by describing the groups which experienced the highest perceived workload during MDR, we have identified the groups which stand to benefit the most from interventions targeted at decreasing the cognitive work associated with MDR. The study also serves as an affirmation that the NASA-TLX is an efficient tool which can be utilized during a time pressured event like MDR. These findings support future works aimed at reducing perceived workload, as quantified with the NASA-TLX, during MDR in the Burn ICU.

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Figures Legends

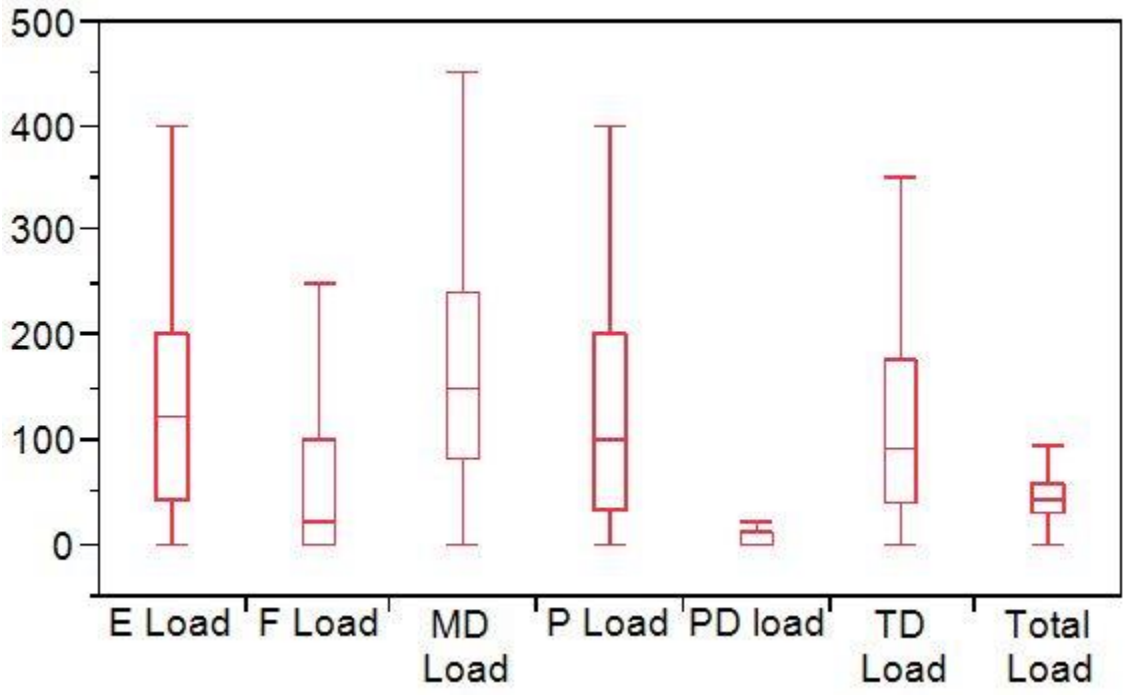


Figure 1. NASA-TLX subscale scores and total load for all survey takers for completion of task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), represented as median (line within box), inner quartile range (box), and range (capped lines). Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

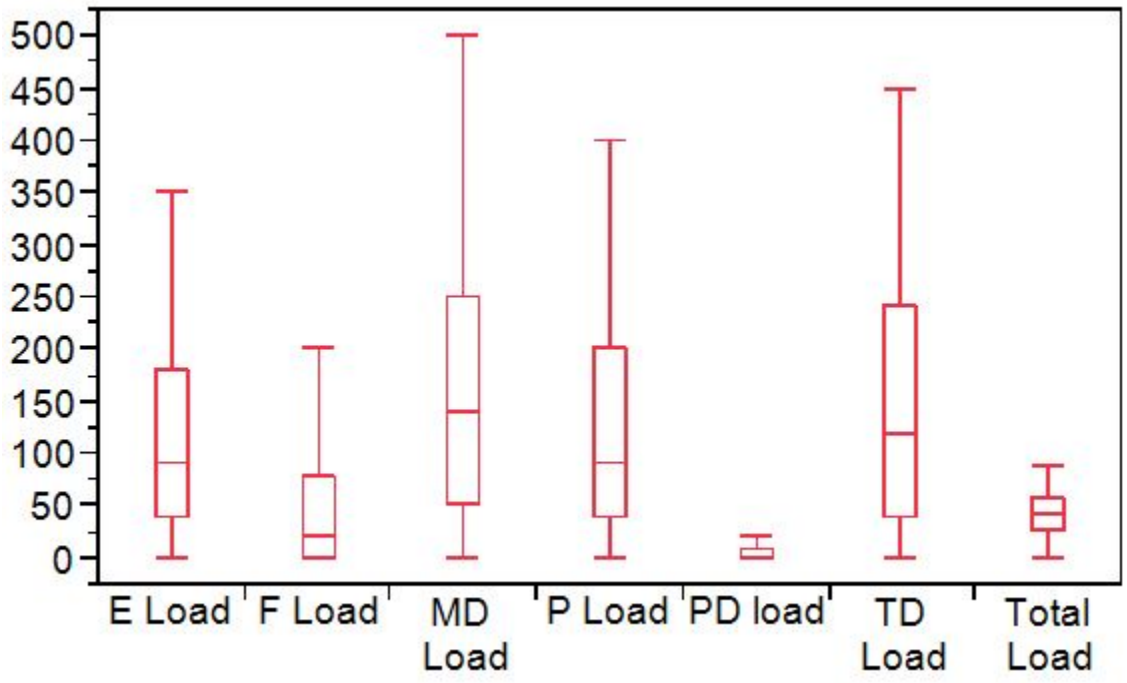
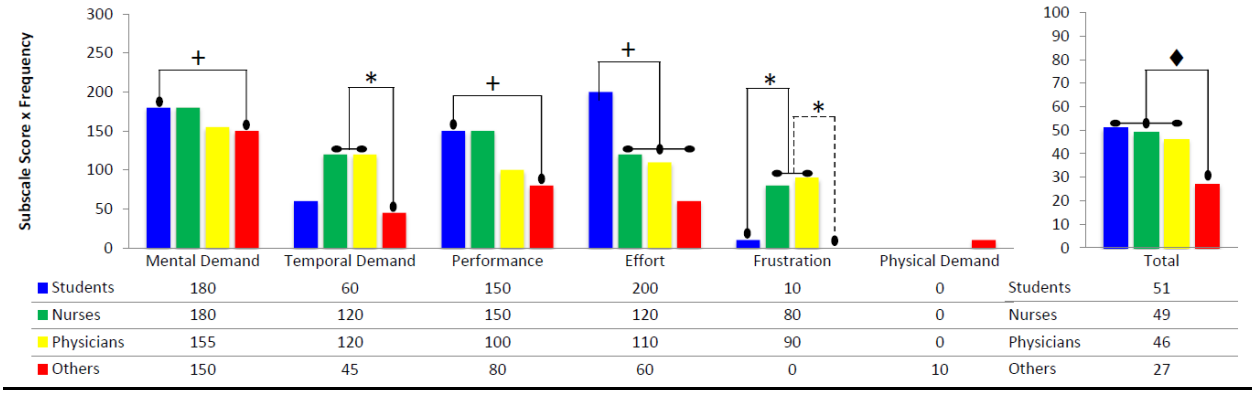


Figure 2. NASA-TLX subscale scores and total load for all survey takers for completion of task 2 ("Identify the priorities of care today" or POC), represented as median (line within box), inner quartile range (box), and range (capped lines). Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.



	Mental Demand	Temporal Demand	Performance	Effort	Frustration	Physical Demand		Total
Students	180	60	150	200	10	0	Students	51
Nurses	180	120	150	120	80	0	Nurses	49
Physicians	155	120	100	110	90	0	Physicians	46
Others	150	45	80	60	0	10	Others	27

Figure 3. Median values for the NASA-TLX subscales and overall workload for completing task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), as compared among clinician groups. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale weight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

♦ P < 0.05 by both methods

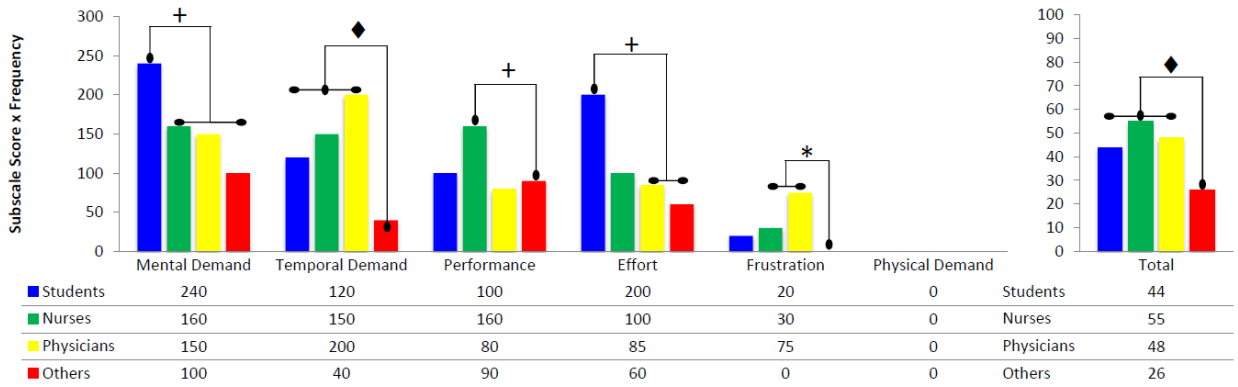


Figure 4. Median values for the NASA-TLX subscales and overall workload for completing task 2 ("Identify the priorities of care today" or POC), as compared among clinician groups. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of a the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

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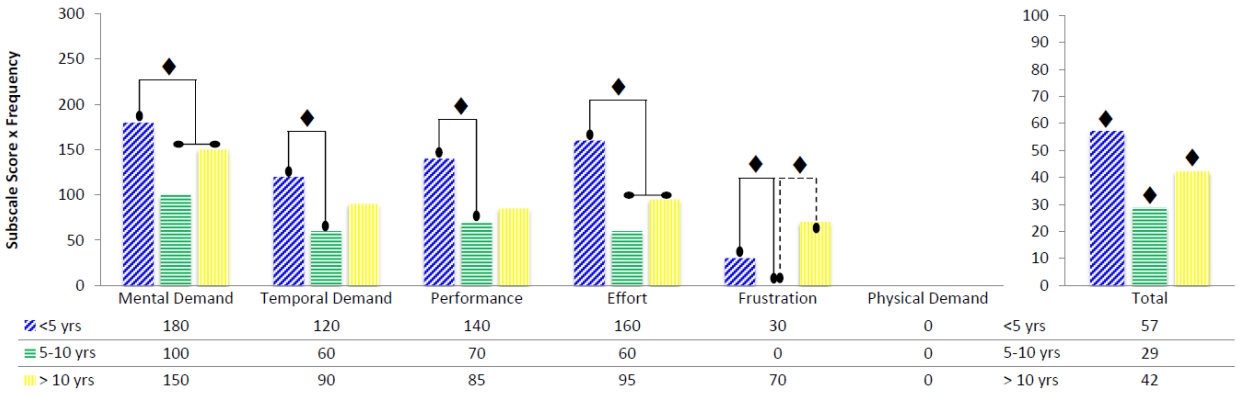

Figure 5. Median values for the NASA-TLX subscales and overall workload for completing task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI), as compared among subgroups defined by years of experience. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

♦ P < 0.05 by both methods

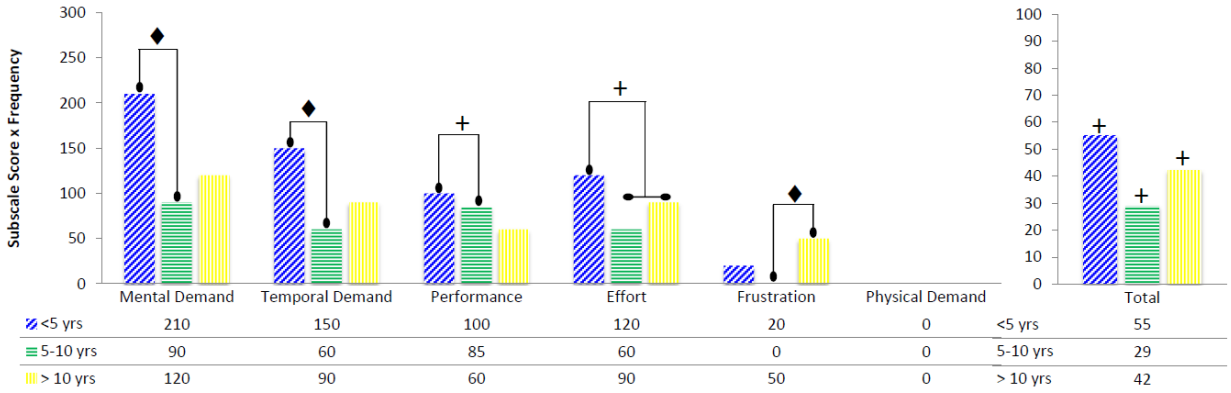

Figure 6. Median values for the NASA-TLX subscales and overall workload for completing task 2 ("Identify the priorities of care today" or POC), as compared among subgroups defined by years of experience. Weighted subscale values range from 0-500 (subscale value 0-100 x subscale wight[5]). The total load scales range from 0-100 and are equal to a sum of the weighted subscale values divided by 15.

** P<0.05 by Steel-Dwass Method*

+ P < 0.05 by Wilcoxon Method

♦ *P < 0.05 by both methods*

Tables

Table 1. Demographic data for our convenience sample of clinicians participating in multidisciplinary rounds and willing to participate in this research describing the size, constitution, and years of experience since graduation from licensing school (or year in school for students) of the four subgroups of survey takers. *CN – charge nurse, CNS – clinical nurse specialist, HN – head nurse, OT – occupational therapist, RT – respiratory therapist.*

Group	n	Average Experience (range)	< 5 yrs	5-10 yrs	>10 yrs
Physician	**41**		**19**	**11**	**11**
Medical Intensivist	3	16.3 (10-27)	0	1	2
Burn Surgeon	11	11.8 (0-16)	~~22~~ 2	1	8
Resident	18	2.1 (0-13)	17	0	1
Fellow	9	5.9 (5-6)	0	9	0
Nurse	**25**		**14**	**5**	**6**
CN/CNS/HN	7	4.3 (0-12)	4	2	1
Nurse	18	8.9 (0-35)	10	3	5
Medical Student	**13**	**2.5 (0-4)**	**13**	**0**	**0**
Other Provider	**37**		**4**	**22**	**11**
Dietician	18	7.4 (5-10)	0	18	0
OT	1	1	1	0	0
Pharmacist	7	12.1 (2-24)	1	3	3
Psychiatry Support	1	13	0	0	1
RT	10	12.6 (4-25)	2	1	7
Total	**116**		**50**	**38**	**28**

Table 2. NASA-TLX subscale scores for all survey takers for completion of task 1 ("Identify if the patient is better, same, or worse than yesterday," i.e. determine the severity of illness, SOI) and task 2 ("Identify the priorities of care today" or POC), ranked by median subscale score. This constitutes a rank-order list describing subscale contributors to overall workload, denoted as "Total" below.

	Task 1: Severity of Illness		**Task 2: Priority of Care**	
Rank Order	**Subscale**	**Average Score (IQR)**	**Subscale**	**Average Score (IQR)**
1	Mental	150 (90-210)	Mental	120 (80-160)
2	Effort	120 (80-160)	Temporal	100 (60-140)
3	Performance	100 (60-140)	Performance	90 (50-130)
4	Temporal	90 (50-130)	Effort	90 (50-130)
5	Frustration	20 (20-20)	Frustration	20 (20-20)
6	Physical	0 (0-0)	Physical	0 (0-0)
Total	**40 (13-67)**		**43 (18-68)**	

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i. Waiver; Amendment. The waiver by either party of or the failure by either party to claim a breach of any provision of this Agreement shall not be, or be held to be, a waiver of any subsequent breach or affect in any way the further effectiveness of any such provision. No term or condition of this Agreement may be waived except by an agreement by the parties in writing.

j. Waiver of Jury Trial. EACH PARTY HEREBY WAIVES ITS RIGHT TO A JURY TRIAL IN CONNECTION WITH ANY DISPUTE OR LEGAL PROCEEDING ARISING OUT OF THIS AGREEMENT OR THE SUBJECT MATTER HEREOF.

[Signature Page Follows]

IN WITNESS WHEREOF, each party to this Agreement has caused this Agreement, effective as of the Effective Date, to be signed by its duly authorized representative.

AUTHOR
PAMPLIN.JEREMY.CHARLES.1042372877

Digitally signed by PAMPLIN.JEREMY.CHARLES.1042372877
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=PAMPLIN.JEREMY.CHARLES.1042372877
Date: 2015.10.09 10:24:48 -05'00'

Print Name: Pamplin, Jeremy

WOLTERS KLUWER HEALTH, INC., OPERATING AS MEDICAL RESEARCH / LIPPINCOTT WILLIAMS & WILKINS

By: _____

Name:

Title:

Schedule A

This Schedule A must be completed by Author in its entirety. The Publisher is unable to publish the Work unless this Schedule A is completely filled out.

Article Tracking #: JBCR-D-15-00153

Article Title (the "Work"): Comparing the workload perceptions of identifying patient condition and priorities of care among burn providers in three Burn ICUs

Corresponding Author Name (the "Author") (please print): Jeremy C. Pamplin

Copyright Owner's Name (please print): U.S. Army

Name of Journal in which Work is to be Published: The Journal of Burn Care & Research

Schedule B

This Schedule B must be completed by Author in its entirety. The Publisher is unable to publish the Work unless this Schedule B is completely filled out.

PUBLIC ACCESS POLICY FUNDING DISCLOSURE

1. Please disclose below if you or any other author of the Work has received funding for research on which the Work is based from any of the following organizations:

☐ National Institutes of Health (NIH)

☐ Howard Hughes Medical Institute (HHMI)

☐ Research Councils UK (RCUK) (Please complete Item 2)

☐ Wellcome Trust (Please complete Item 2)

2. If you have selected either Research Councils UK or Wellcome Trust from the above list, please disclose the Open Access option to which the Work will be subject:

☐ Gold route

☐ Green route

NOTE: If the "Gold" route has been selected, Section 3.b. of the Agreement will apply to the Work, and neither Section 3.a. nor Section 3.c. of the Agreement will apply to the Work. If the "Green" route has been selected, Section 3.c. of the Agreement will apply to the Work, and neither Section 3.a. nor Section 3.b. of the Agreement will apply to the Work.

3. ☐ This Schedule B is inapplicable to the Work.

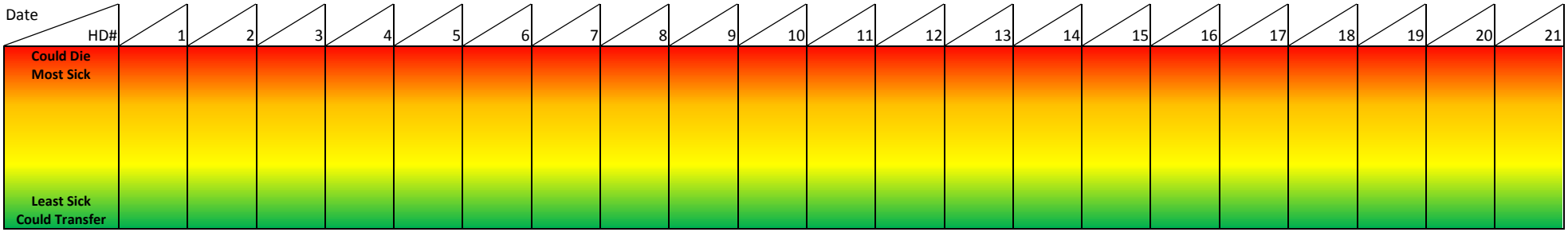
CORE Site (USAISR) Tools

1. Original TeamView
2. Original Scales Tool
3. Updated TeamView
4. Updated ECMO TeamView
5. Updated Resident Scales/Checklist/Presentation Tool
6. Updated Nurse Scales/Checklist/Handoff Tool

Team View

Patient Severity of Illness, Status, and Goals

Severity of Illness *(transfer from scales tool)*



Status

% Open																				
Hrs Sleep Last Night																				
Coordinating Activities *See code list behinde Scales Tool for codes.*																				

Update Checklist items daily!

	NA	Good	Discuss
GI Prophylaxis	☐	☐	☐
CHG Prophylaxis	☐	☐	☐
HOB > 30 degrees	☐	☐	☐
DVT Prophylaxis	☐	☐	☐
Last BM < 48 hrs ago	☐	☐	☐
Respiratory Orders Current	☐	☐	☐
Family has questions	☐		☐
Delirium Positive	☐		☐
Pending Cultures	☐		☐

Antibiotic(s) NA ☐	*Effective Start Date*	*Planned Stop Date*	*Diagnosis*

Goals *(completed during rounds)*

Fluid volume goal for today:

- ☐ Positive
- ☐ Negative
- ☐ Even

Major Goal(s) for the next 24-48 hours:

A. Patient's Current Condition.

Room:_____ Date/Time:_____

Please make a noticeable "X" ANYWHERE on ANY of the scales below that indicates your estimate of the patient's condition right now.

Diagnoses & Problems *Worse = Increasing in number or severity; Better = Decreasing in number or severity*

Getting Worse Quickly | Worse | Same | Better | Better Quickly

Organ support (Mechanical Ventilation, CRRT, Vasopressors, Blood Products, Etc.)

Maximal or Increasing rapidly | High, new, or increasing in amount or number | Stable in amount or Number | Low or Decreasing in amount or number | Permanent or Chronic | None

Mental Status

Paralyzed | Comatose Sedated | Agitated Delirium or Encephalopathy | Hypoactive Delirium or Follows Commands | Alert, Normal, [Baseline]

Acuity Level

Highest/Very Complex | High or Increasing | Standard or Decreasing | Low

Wounds

Fungus/necrosis Wound Fialure (<20% healed @ 3 weeks) | Unexcised full thickness Delayed healing < 50% @ 3 weeks | Stable Healing | Small/Minimal < 10% Open

Risk of Worsening or Sepsis

High | Medium | Low

Severity of Illness *(your summary assessment of the above scales)*

Most sick, Could Die ... Least Sick Could transfer

B. Patient's Current Treatments

Make a noticeable "X" ANYWHERE the scales below that indicates the patient's current treatments.
Text in each section is organized by objective/goal in bold type, recommendations in regular type, and considerations in italic type.

Analgesia & Sedation

Deep Sedation +/-Paralyzed
***Decrease O_2 Consumption**
Continuous + PRN
Narcotics and Sedatives

Moderate Sedation (RASS -1 to -2)
***Safety and Comfort**
Scheduled/PRN Narcotics
PRN Sedatives

Light Sedation (RASS 0 to -1)
***Patient Comfort, Minmal Pain**
PRN/Scheduled Narcotics
+/- Scheduled Enteral Narcotics

No Sedation (RASS 0)
***Participatory Patient**
PO/Enteral PRN Narcotics
Symptomatic Tx of Anxiety

Sleep *Goal: Minimize Delirium*

As Able
Day/Night Cycle

Goal 4-6 hours
Avoid awakening 4-6 hrs at night
Day/Night Cycle

Use Sleep Protocol
Avoid awakening 6-8 hrs at night
Day/Night Cycle
Sleep aid

Ventilation *Goal: Minimize VILI, liberation ASAP*

Controlled/Assisted (vent does Work of Breathing)
Low Tidal Volume (Vt) or VDR
Open Lung Approach: ↑PEEP, ↓Vt

Wean/Decrease with Supported Mode
Transition to APRV or CPAP or CPAP/PS
Decrease FiO_2 First, then PEEP/MAP

Spontaneous/Liberated
Transition to CPAP, extubate, or trach collar
Tracheostomy, speaking valves

Monitoring Standard monitoring (Tele, SpO2, RR, NBP) plus the following:

Maximize knowledge
A-Line, CVP, EV1000, $EtCO_2$
Continuous SvO2, Abdominal Pressures, [TTE/IVC measurement]

Assure effective Ventilation & Sedation (Standard ICU)
$EtCO_2$,
A-Line, ±CVP

4E Compatible
Decrease NBP measurements overnight
Remove Foley

Nutrition *Goal: Minimize loss of lean mass*

Holding Enteral Feed, Consider TPN

Enteral Feeds at *Trickle (20mL/hr)*

Enteral feeds Increasing to full support

Full Support Enteral

Full Support Enteral and PO including supplements

Full support PO solids and supplements

Fluid Goal *Goal: Maintain organ perfusion; Avoid volume overload*

Targeted Resuscitation/No over resuscitation
Give fluids only to achieve defined goal
Lactate decrease by 10% in 4 hrs
$ScvO_2$ > 70%, UOP > 0.5ml/kg/hr
Blood and Colloids to avoid over resuscitation

Targeted Management for Euvolemia
Assess intravascular volume status daily
Define Goal of Positive, Negative, or even
Fluid challenge
Diuretic challenge

Self-Management of Fluid Balance
No maintenance fluids

CRRT (Check if NA ☐)

Consider High Dose Therapy | Regular Dose | Breaks for activities and tests | *Consider IHD*

Labs *Goal: Information availability & minimize blood loss*

More Frequent
Q4-Q6: ABG, VBG/SvO_2, Lactate, CBC, Chem
Q12-24: LFT
**Pedi Tubes*, TEG, Coags, Fibrinogen*

Less Frequent
Q12-Q24: ABG, CBC, Chem
Q24-Qweek: LFT, Coags
Weekly Nutrition Labs

As Needed/Intermittent
QOD-QMWF: CBC, Chem
Qweek: LFT, Coags
PRN Labs only

Access

Adequate access
Central line ≥ 3 ports
Arterial Line

Balance access and Infection
Remove arterial line
If on CRRT, Triple lumen dialysis catheter as only central access

Minimize Infection
Peripheral, fewer
Power Wand
PICC

Wound Care *Goal: Minimize wound infection, Suffering, & Heat loss*

Complex dressing, NPWD placement/takedown > 40% or lg dressing with shower/staple removal | 30-40% mod complex or shower type < 2 hours or no post op dressing change | Smaller or basic dressing or postop with wet downs, <20% | *Simple/Self-care*

Rehabilitation

Total Care
None or ROM/Positioning as tolerated
Other care is important

As much as tolerated
General Progression: ROM -> Sit/TLC -> Dangle/Tilt/Stand
Rehab likely more important

Minimal Assist
to March/Walk -> Gym & Outside!
Rehab most important, DO NOT DELAY

Medications *Goal: Minimize polypharmacy*

More continuous
More IV

Continuous + PRN
More IV + Enteral

PRN + More Scheduled
Mixed IV + Enteral
Some PO

More PO
Some Enteral

Team View

Patient Severity of Illness, Status, and Goals

Severity of Illness *(transfer from condition assessment tool)*

Allergies _____ Code Status _____

Date																					
Hosp. Day/ICU Day	/1	/2	/3	/4	/5	/6	/7	/8	/9	/10	/11	/12	/13	/14	/15	/16	/17	/18	/19	/20	/21
Could Die Most Sick																					
Least Sick Could Transfer																					

Status

Place "X" or description where these occur and and the days post procedure in the boxes above the blue line. *Circle* planned events

% Open OR																					
Central Line																					
Arterial Line																					
Dialysis Cath																					
Extubation																					
Intubation																					
BM																					
Cultures																					
Dressings "Down-Day"																					
Rehab Completed																					
Other Events (e.g. family meeting, etc.)																					

Recommendations/Messages	*Antibiotic(s)* *NA* ☐	*Effective Start Date*	*Planned Stop Date*	*Diagnosis*

Goals *(completed during rounds)*

Fluid volume goal for today:

☐ Positive _____ L

☐ Negative _____ L

☐ Even = + _____ L

The most important goal(s) for today (what we must do to be successful):

_____

_____

_____

Priorities:

___ Wound Care ___ Rehab

___ Procedure(s) ___ Imaging

___ SH/BT ___ Extubation

___ Other_____

Team View

Patient Severity of Illness, Status, and Goals

Severity of Illness *(transfer from scales tool)*

Allergies _____ Code Status _____

Date HospDay/ECMO Day	/1	/2	/3	/4	/5	/6	/7	/8	/9	/10	/11	/12	/13	/14	/15	/16	/17	/18	/19	/20	/21
Could Die Most Sick Could Decannulate																					

Status

Flow/ RPM																					
Delta P																					
Circuit PaO2																					
Sweep																					
Patient PaO2																					
Patient PaCO2																					
Compliance																					
PRBC																					
FFP																					
PLT																					
Cryo																					
Amicar/TXA																					
Rehab																					
Other Events (e.g. Procedures)																					

Recommendations/Messages	*Antibiotic(s)* *NA* ☐	*Effective Start Date*	*Planned Stop Date*	*Diagnosis*

Goals *(completed during rounds)*

Fluid volume goal for today:

☐ Positive _____ L

☐ Negative _____ L

☐ Even = + _____ L

The most important goal(s) for today (what we must do to be successful):

_____

_____

_____

_____

Priorities:

___ Wound Care ___ Rehab

___ Procedure(s) ___ Imaging

___ Other_____

Page 1: Nursing Illness Severity Assessment

Bed #: **Time/Date:**

Instructions: *Make a noticeable "X" ANYWHERE on ANY of the scales below that indicates your estimate of the patient's condition right now. Use the "average" of these marks to identify the Illness Severity (summary assessment) at the bottom. Transfer that summary assessment to the scale at the top of Page 2.*

Step 1

Acuity

Worse	Standard or Decreasing/Moderate	Minimal/Low
Very Complex	>>>>>>Getting Better>>>>>>>>>>>>>>>>>>>>>	Complexity
MD rounding ≤ Q2 hrs!	2-7 Drips	Q12-24 hr labs, 1-2/day
8-9 Drips	Q6-24 hr labs, 1-4/day	Standard ICU Monitoring
≥Q6 hr labs, > 6/day	Arterial Line	(Foley, Tele, SpO2, +/- CVP)
CO Monitoring, EtCO2		

Diagnoses & Problems

Current or Chronic Problems: Bad <<< Getting Worse <<<< Same >>>> Getting Better >>> Baseline

Worse *= Increasing in number or severity;* ***Better*** *= Decreasing in number or severity*

Neuro/Pain

Sedation Goal	RASS -4 to -5 Paralyzed	RASS -1 to -3	RASS 0 to -1	RASS 0

Notes:

Respiratory

Mechanical Ventilation	Low Tidal Volumes PEEP>16 or MAP>28 iNO Rotaprone	PCV, VDR, or APRV PEEP>12 or MAP>18	APRV or CPAP/PSV Breathing Trials Weaning	Off-Vent Chronic vent
FiO2/Oxygenation	100% FiO2, P:F < 100 or OI>35 SpO2 < 90	70-80% FiO2 P:F 100-200 or OI > 25 SpO2>90	40-60% FiO2 P:F >200 or OI > 14 SpO2 > 90	< 40% FiO2 P:F > 300 or OI < 15 SpO2 Normal or Baseline

Notes:

Cardiac

Vasopressors	Levophed > 25	Levophed < 25 Vasopressin 0.04	Levophed < 25 Vasopressin 0.04	No Vasopressors

Acidosis/Shock	pH< 7.2 Lactate > 6/increasing Trending ScvO2 often	pH 7.2-7.3 or > 7.5 Lactate decreasing or normal	pH 7.3-7.5 Not checking lactates

Notes:

GI Notes

Renal/GU

RRT	High volume CVVH	CVVH	None or IHD

Goal UF:

BUN/Cr:

Notes:

Endo *Accuchecks:*

Notes:

Heme

Blood & Fluids	Belmont in the room	Fluid loading	Goal Negative or Even

Blood Products Given: **PRBC** **FFP** **PLTS** **Cryp**

Labs/ABG/pH

Frequency	> Q6	Q6-Q24	≤Q24
Electrolytes/Labs	K > 6 or ECG changes DIC with bleeding	DIC	Normal

Notes:

Skin/Wounds

Notes:	Bad (IFI or Necrosis) Extensive (> 70% *open*)	Not Bad Medium Sized (20-70% *open*)	Good Small (< 20% *open)*

Rehabilitation

None ROM>>>

Sitting/TLC>>

Stand/Tilt>>

Walking>>>>>>>>>>>>>

ID ***Tmax:*** ***WBC:*** ***ABX:*** ***Day/Reason:***

Notes:

Risk of Worsening

High = *Any of the Following*	**Medium**	**Low = All of the following**
WBC (> 15/rising or < 4/dropping)	Febrile	Normal/Stable WBC
Hypothermic (< 36/<96.8)	Not tolerating rehabilitation	Normal Temperature
Worsening Mental Status	Increasing Gastric Residuals	Normal Vital Signs
Increasing HR or RR, or decreasing MAP	Increasing Blood Glucose or Insulin Requirement	Tolerating feeding
		Stable insulin requirment
		Tolerating rehabilitation

Step 2

Severity of Illness

(summary assessment)

*****Copy to the Next Page*****

Most sick, Could Die ... Least Sick Could transfer

If the patient's SOI changes by 2 or more blocks, page the on-call resident or attending to discuss.

Page 2: Assessment & Recommendations: Patient's CURRENT Treatments

Step 3. ***Instructions:***

- *Mark **current** treatments.*
- *Note discrepancies between current treatments & the intended treatments according to patient condition.*

Severity of Illness

Analgesia & Sedation

	Intubated Patients Only		Intubated and Non-Intubated Patients	
	Deep Sedation (RASS -4 to -5) +/-Paralyzed *Non-Responsive*	**Moderate Sedation (RASS -1 to -3)** *Arousable (opens eyes, withdraws)*	**Light Sedation (RASS 0 to -1)** *Interactive (follows commands)*	**No Sedation (RASS 0)** *Participatory (expresses self)*
	☐ minimize oxygen demand ☐ maximize perfusion ☐ protect grafts	☐ patient ventilator synchrony ☐ prevent agitated movements ☐ protect grafts, tube/line/device	☐ prevent patient harm ☐ engage patient in care ☐ more physical/occupational therapy	☐ maximize patient engagement & participation in care ☐ maximize rehabilitation
	☐ **Continuous** **+** ☐ **PRN**	☐ **Continuous** **+** ☐ **PRN**	☐ **Scheduled IV/Enteral/PO** **+** ☐ **PRN IV or Enteral/PO**	☐ **Scheduled IV or Enteral or PO +** ☐ **PRN Enteral > IV**

Notes/Recommendations:

Delirium

Prevention	☐ Day-Night Light Cycle	☐ Day-Night Light Cycle ☐ Un-Interrupted Sleep, 4-6 hrs ☐ Physical activity ☐ Consider ear plugs	☐ Day-Night Light Cycle ☐ Sleep, 4-8 hrs ☐ Increase mobility ☐ Consider ear plugs, sleep aid
Treatment	☐ NA	☐ Dexmedetomidine drip ☐ Haloperidol IV Push	☐ Haloperidol IV Push ☐ Quetiepine PO/Enteral

Notes/Recommendations: **Sleep aide dose:**
Restraints: Y/N
Hours of Sleep:

Monitoring/ Lines

Standard monitoring (Tele, SpO2, RR, NBP)

Maximize knowledge
Standard ICU Plus:
Trend:
☐ Abdominal Pressures
☐ TTE/IVC size
☐ Continuous CO/SVV/SVR

Assure effective Ventilation & Sedation
Standard ICU Plus:
☐ Foley
☐ EtCO2
☐ A-Line
☐ ±CVP

Ward Compatible
☐ Standard ICU
Consider:
☐ Decrease NBP measurements overnight
☐ Remove Foley

Lines:
Notes/Recommendations:

Mechanical Ventilation

☐ Paralysis
☐ VDR Protocol
☐ PCV Protocol
☐ ARDS Algorithm
☐ APRV Protocol
☐ Oscillatory/Demand CPAP protocol
☐ CPAP/PSV Protocol
☐ Daily breathing trials and/or wean
☐ CPAP/CPAP-PS Protocol
☐ Trach collar/speaking valve
☐ NA, not on mechanical ventilation

Notes/Recommendations:

Nutrition

☐ Holding Enteral Feeds
☐ Consider TPN
☐ Goal = full enteral support
☐ If unable to achieve, use TPN
☐ Goal is transition to PO solids and supplements

Notes/Recommendations: **Last BM:**
FMS: Y/N
TF Goal:
Steroids: Y/N
PPI: Y/N

Labs

Q4-Q6:
☐ ABG
☐ VBG/SvO2
☐ Lactate
☐ CBC
☐ Chem
Consider:
☐ TEG
☐ Coags
☐ Fibrinogen
Q12-24:
☐ LFT
☐ Drug Levels
☐ *Pedi Tubes*

Q8-Q24:
☐ ABG
☐ CBC
☐ Chem
☐ LFT
☐ Coags
Consider:
☐ Drug Levels

Q24-QOD:
☐ CBC
☐ Chem
☐ Qweek:
☐ LFT
☐ Coags
Consider:
☐ Drug Levels
☐ PRN Labs only

Notes/Recommendations: **DVT Prophy: Y/N**

Rehabilitation

None or As Able
☐ None or
☐ ROM/Positioning Q2hrs
☐ Splinting

As Tolerated to Maintain or Improve Function
☐ General Progression: ROM →
☐ Bed-to-Chair Position/Cardiac Chair →
☐ Danlge/Tilt/Stand
☐ *Splinting*

Improve Function
☐ to March/Walk →
☐ Go Outside!
☐ *Splinting*

Notes/Recommendations:

If all checks are not aligned with the the patient's SOI, discuss with the physicians.

Notes/Plan

Page 1. Burn Illness Severity Assessment

Bed #: **Time/Date:**

***Instructions**: Make a noticeable "X" ANYWHERE on ANY of the scales below that indicates your estimate of the patient's condition right now. Use the "average" of these marks to identify the Illness Severity (summary assessment) at the bottom. Transfer that summary assessment to the scale at the top of Page 2.*

Step 1

Acuity	Worse Very Complex MD rounding ≤ Q2 hrs! 8-9 Drips ≥Q6 hr labs, > 6/day CO Monitoring, EtCO2	Standard or Decreasing/Moderate >>>>>>Getting Better>>>>>>>>>>>>>>>>>>>>> 2-7 Drips Q6-24 hr labs, 1-4/day Arterial Line		Minimal/Low Complexity Q12-24 hr labs, 1-2/day Standard ICU Monitoring (Foley, Tele, SpO2, +/- CVP)
Diagnoses& Problems *Current or Chronic:*	Bad	<<< Getting Worse <<<< Same	>>>> Getting Better >>>	Baseline
Worse = Increasing in number or severity; Better = Decreasing in number or severity				
OrganSupport				
Sedation Goal	RASS -4 to -5 Paralyzed	RASS -1 to -3	RASS 0 to -1	RASS 0
Mechanical Ventilation	Low Tidal Volumes PEEP>16 or MAP>28 iNO Rotaprone	PCV, VDR, or APRV PEEP>12 or MAP>18	APRV or CPAP/PSV Breathing Trials Weaning	Off-Vent Chronic vent
Vasopressors	Levophed > 25	Levophed < 25	Levophed < 25 Vasopressin 0.04	No Vasopressors
RRT	High volume CVVH		CVVH	None or IHD
Blood & Fluids	Belmont in the room	Fluid loading	Goal Negative or Even	
Labs/ABG/pH				
Frequency	> Q6	Q6-Q24		≤Q24
Acidosis/Shock/	pH< 7.2 Lactate > 6/increasing Trending ScvO2 often	pH 7.2-7.3 or > 7.5 Lactate decreasing or normal		pH 7.3-7.5 Not checking lactates
Electrolytes or Labs	K > 6 or ECG changes DIC with bleeding	DIC		Normal
Respiratory ***FiO2/Oxygen (P:F, SpO2)***	100% FiO2, P:F < 100 or OI>35 SpO2 < 90	70-80% FiO2 P:F 100-200 or OI > 25 SpO2>90	40-50% FiO2 P:F >200 or OI > 14 SpO2 > 90	< 40% FiO2 P:F > 300 or OI < 15 SpO2 Normal or Baseline
Wounds	Bad (IFI or Necrosis) Extensive (> 70% open)	Not Bad Medium Sized (20-70% open)		Good Small (< 20% open)
Rehabilitation	None ROM>>>	Sitting/TLC>>	Stand/Tilt>>>	Walking>>>>>>>>>>>>>
Risk Of Worsening	**High = *Any of the Following*** WBC (> 15/rising or < 4/dropping) Hypothermic (< 36/<96.8) Worsening Mental Status Increasing HR or RR, or decreasing MAP	**Medium** Febrile Not tolerating rehabilitation Increasing Gastric Residuals Increasing Blood Glucose or Insulin Requirement		**Low = All of the following** Normal/Stable WBC Normal Temperature Normal Vital Signs Tolerating feeding Stable insulin requirment Tolerating rehabilitation

Step 2

Illness Severity ***(summary assessment)*** ***Copy to Next Page***

Most sick, Could Die — Least Sick Could transfer

If the patient's SOI changes by 2 or more blocks, discuss during a "huddle."

Review QA checklist daily. Discuss problems on rounds.

	NA	Yes	No		NA	Yes	No
Appropriate GI Prophylaxis (PPI if > 20%TBSA)?	☐	☐	☐	Respiratory orders current?	☐	☐	☐
Appropriate DVT Prophylaxis (Medical if > 20%TBSA)?	☐	☐	☐	Wound care order current?	☐	☐	☐
Receiving appropriate oral care (CHG Q6 if intubated, BID teeth brushed if not)?	☐	☐	☐	Family has questions to discuss (ask nursing)?	☐		☐
HOB > 30 degrees (higher if indicated)?	☐	☐	☐	Delirium Positive?	☐		☐
Last BM < 48 hrs ago?	☐	☐	☐	Restraints needed?	☐		☐
Polypharmacy minimized (orders "cleaned")?	☐	☐	☐	Current treatments match current condition (see next page)?		☐	☐

Page 2. Illness Severity Checklists

Step 3. ***Instructions:*** *Mark* ***current*** *treatments in the white areas. Note discrepancies between current treatments & the intended treatments according to patient's severity of illness. Present information in* ***grey*** on rounds.

One Liner:

24 hr events/rehab tolerance/Subjective:

Severity of Illness

Neuro

Analgesia & Sedation

	Intubated Patients Only		Intubated and Non-Intubated Patients	
	Deep Sedation (RASS -4 to -5) +/-Paralyzed *Non-Responsive*	**Moderate Sedation (RASS -1 to -3)** *Arousable (opens eyes, withdraws)*	**Light Sedation (RASS 0 to -1)** *Interactive (follows commands)*	**No Sedation (RASS 0)** *Participatory (expresses self)*
	☐ minimize oxygen demand ☐ maximize perfusion ☐ protect grafts ☐ Continuous + PRN	☐ patient ventilator synchrony ☐ no agitated movements ☐ protect grafts, T/L/D ☐ Continuous + PRN	☐ prevent patient harm ☐ engage patient in care ☐ more physical/occupational therapy ☐ Scheduled IV/Enteral/PO + PRN IV or Enteral/PO	☐ maximize patient engagement & participation in care ☐ maximize rehabilitation ☐ Sched. IV/Enteral/PO + PRN Enteral > IV

Delirium

Prevention	☐ Day-Night Light Cycle	☐ Day-Night Light Cycle ☐ Un-Interrupted Sleep, 4-6 hrs ☐ Physical activity ☐ Consider ear plugs ☐ Dexmedetomidine drip ☐ Haloperidol IV Push	☐ Day-Night Light Cycle ☐ Sleep, 4-8 hrs ☐ Increase mobility ☐ Ear plugs, sleep aid ☐ Haloperidol IV Push ☐ Quetiepine PO/Enteral
Treatment	☐ NA		

Exam (Pupils/MS/Focality)_____ Current Narcotics/Dose last 24 hrs_____ **Notes/Plan:**

GCS:_____CAM ICU:_____ Hrs of sleep:_____ Current Sedatives/Dose last 24 hrs_____

Imaging: Other meds

Pulm

Mechanical Ventilation

☐ NA, not on mech. ventilation

☐ Paralysis ☐ VDR Protocol ☐ PCV Protocol ☐ ARDS Protocol ☐ APRV Protocol ☐ Oscillatory/Demand CPAP protocol ☐ CPAP/PSV Protocol ☐ Daily breathing trial and/or wean ☐ CPAP/CPAP-PS Protocol ☐ Trach collar/speaking valve ☐ No Daily CXR

ECMO

LPM_____RPM_____

VenPres_____ArtPres_____ΔPress_____

SweepFlow_____FiO2_____

Pt ABG_____

Pt SvO2_____

Circuit PaO2_____

VDR: PIP_____PEEP_____OsPEEP_____MAP_____FiO2_____

AC: Vt_____mL/kg_____f(set/tot)_____Peep_____FiO2_____Ppk_____Pplat_____

PC: PIP_____f(set/tot)_____Peep_____FiO2_____Vt_____ml/kg_____

PS: PS_____PEEP_____f_____FiO2_____Vt_____ml/kg_____

APRV: PH_____PL_____TH_____TL_____FiO2_____Vt_____MVtot/spont_____

RR/Sats:_____Exam: ABG_____P:F_____ OI[(MAPxFiO2)/PaO2]_____ **Notes/Plan:**

CV

Monitoring

Standard monitoring (Tele, SpO2, RR, NBP)

Maximize knowledge
Standard ICU Plus:
Trend:
☐ Abdominal Pressures
☐ TTE/IVC size
☐ Continuous CO/SVV/SVR

Assure effective Ventilation & Sedation
Standard ICU Plus:
☐ Foley
☐ EtCO2
☐ A-Line
☐ ±CVP

Ward Compatible
☐ Standard ICU
Consider:
☐ Decrease NBP measurements overnight
☐ Remove Foley

HR_____ BP_____MAP_____ CVP_____ CO/CI_____ SVR _____ Lactate/SvO2: _____ **Notes/Plan:**

Exam_____Pulses:_____Meds:

GI

Nutrition

☐ Holding Enteral Feeds
☐ Consider TPN
☐ Goal = full enteral support
☐ If unable to achieve, use TPN
☐ Goal is transition to PO solids and supplements

Exam: LFTs/Amy/Lip_____ **Notes/Plan:**

Imaging: PreAlb/UUN/Metabolic Cart:

Feeding_____Residuals:_____Last BM_____ Meds:

Labs

Q4-Q6:
☐ABG, SvO2, Lactate, CBC, Chem
Consider:
☐ TEG, Coags
☐ Fibrinogen
Q12-24:
☐ LFT
☐ Drug Levels

Q8-Q24:
☐ ABG, CBC, Chem, LFT, Coags
Consider:
☐ Drug Levels

Q24-QOD:
☐ CBC, Chem
Qweek:
☐ LFT, Coags
Consider:
☐ PRN Labs only

Renal

I_____O_____Net_____UOP/hr_____

Est Insens loss (1cc/kg/tbsa)_____

Weight_____

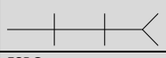
Drain OP: Gastric_____CT's_____JP's_____NPWD_____Other(s)_____ **Notes/Plan:**

CRRT: ◯Prisma ◯NxStage BFR_____RFR_____Solution_____UF_____

Anticoagulation_____Filter Life (hrs)_____

Dose (RFRxHrs on/24/kg)_____FF_____

Other Studies:



C_____M_____P_____ IV Drips:_____

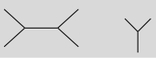
Meds:

Endo

FSBGs_____ Insulin Tot_____ Meds: **Notes/Plan:**

Other (TSH,Cortisol, etc.)

Heme



TEG-R α MA Ly30 RBCs_____FFP_____PLT_____Cryo_____ **Notes/Plan:**

Others: Other

ID

Tmax/TCurrent WBC/Diff **Notes/Plan:**

Cultures ABX (Day#/of#) & Levels

Rehabilitation

None or As Able
☐ None or
☐ ROM/Positioning Q2hrs
☐ Splinting

As Tolerated to Maintain or Improve Function
☐ General Progression: ROM →
☐ Bed-to-Chair Position/Cardiac Chair →
☐ Danlge/Tilt/Stand
☐ *Splinting*

Improve Function
☐ to March/Walk →
☐ Go Outside!
☐ *Splinting*

Wnds

Exam: _____Current % Open:_____Current Wound Care: **Notes/Plan:**

Last OR_____Next OR:_____ Next Dressings Down Day:_____

T/L/D

CVC Location/Day_____ ETT (size/depth)_____ **Notes/Plan:**

AL Location/Day_____Foley(day)_____FMS(day/last DRE)_____

NGT/DHT: Other:

****Place sheet in the box labeled POIP Study at the end of the day****

Houston Site Tools

1. Original TeamView
2. Original Scales Tool

A. Patient's Current Condition.

Room:_____ Date/Time:_____

Please make a noticeable "X" ANYWHERE on ANY of the scales below that indicates your estimate of the patient's condition right now.

Acuity

Highest/Very Complex/Most | High or Increasing/Many | Standard or Decreasing/Moderate | Minimal/Low Complexity/Few

Diagnoses & Problems

Problems of systems: Neuro, CV, Pulm, GI, Renal, Endo, ID, Heme, MSK, etc.

Getting Worse Quickly | Increasing Support <<<<<< Getting Worse >>>>>>> | Same | >>>>>>>>>Getting Better >>>>>> Decreasing Support | Baseline

Worse = Increasing in number or severity — *Better = Decreasing in number or severity*

General Condition

Getting Worse Quickly | Worse or Same | Baseline Normal

Same or Getting Better | Getting Better Quickly

Organ Failures

Brain, Lungs, Heart, Vascular, Bowel, Liver, Kidney, Coagulation, Skin

MODS (≥ 3 systems) | 1-3 systems | 1-2 Systems | 1 System | None or Chronic

Organ support is

Mechanical Ventilation, RRT, Vasopressors, Blood Products, Etc.

Maximal or Increasing rapidly | High, new, or increasing in amount or number | Stable in amount or Number | Low or Decreasing in amount or number ("Weaning") | Permanent or Chronic | None

Labs/ABG/pH

Frequent labs to monitor Acidosis/Shock/Major Derangement pH< 7.2, Lactate > 4, SvO2 < 60% Major electrolyte abnl (e.g. K > 6)

Daily or more frequent labs that show Acidosis, Electrolyte abnormality(ies), coagulopathy, anemia, or changing organ function (better or worse)

Daily, less frequent, or PRN labs that are Normal or Baseline

Mechanical Ventilation Peep/Mode

High PEEP > 15, Increasing Support, Not Tolerating, Significant Dyssynchrony | Support Not Changing | Extubated/Off Ventilation or Chronic CPAP/PS or Trach Collar

>>>>>>>>>> Decreasing Support >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

FiO2/Oxygenation (P:F, SpO2)

100% FiO2, P:F < 100, SpO2 < 90 | 70-80% FiO2, P:F 100-200 SpO2>90 | 40-50% FiO2 P:F >200 SpO2 > 90 | < 40% FiO2, P:F > 300 SpO2 Normal or Baseline

Monitors/Interventions

Many or Increasing and invasive: Monitors, IV Drips, Tubes/Lines/Drains

>>Decreasing or few & less invasisve: Monitors, Drips, T/L/D>>

<<<<<<<<<Increasing Monitors, IV Drips, T/L/D<<<<<<<<<<

No IV Drips or Invasive Monitors (except Foley)

Mental Status

Paralyzed | Very Diminished, Grimaces Only Comatose,Sedated | Agitated Delirium or Diminished | Hypoactive Delirium or Follows Commands | Alert, Normal, Baseline

Wounds

☐***Pre-Operative***
☐***Post-Operative***

Large/Extensive Deep burns | Medium Sized Mized Burn Depth | Small/Minimal Superficial/Superficial Partial Only

Risk of Worsening or Sepsis

High = All of the Following
High WBC (> 15/rising) or Low WBC (< 4/dropping)
Hypothermic
Worsening Mental Status
Increasing HR or RR, or decreasing MAP

Medium
Febrile
Not tolerating rehabilitation
Increasing Gastric Residuals
Increasing Blood Glucose or Insulin Requireement

Low = All of the following
Normal/Stable WBC
Normal Temperature
Normal Vital Signs
Tolerating feeding
Stable insulin requirment
Tolerating rehabilitation

Severity of Illness (summary assessment)

Most sick, Could die today — Leaset Sick, Could transfer today

B. Patient's Current Treatments

Make a noticeable "X" ANYWHERE the scales below that indicates the patient's current treatments.
Text in each section is organized by objective/goal in bold type, recommendations in regular type, and considerations in italic type.

Analgesia & Sedation

Maximal/Controlled Sedation
Fentanyl & Versed +/-
Paralyzed
IV Continuous + IV Scheduled & PRN Narcotics and Sedatives

Moderate Sedtion
(RASS -3 to -2)
***Arousable Patient**
IV/Enteral Scheduled/PRN Narcotics & Sedatives

Light Sedation
(RASS -2 to -1)
***Weaning**
PO/Enteral PRN Narcotics
+/- Scheduled Enteral Narcotics

No Sedation More Awake
(RASS 0)
***Participatory Patient**
PO/Enteral PRN Narcotics
Symptomatic Tx of Anxiety

Mechanical Ventilation

Goal: Minimize VILI, liberation ASAP

Controlled/Assisted
(vent does Work of Breathing)
VDR or Low Tidle Volume (Vt) AC/VC
Open Lung Approach: ↑PEEP, ↓Vt

Wean/Decrease with Supported Mode
Transition to
APRV or CPAP or CPAP/PS or AC/VC
Sedation Holiday/Breathing Trial

Spontaneous/Liberated
Sedation Holiday/Breathing or Trach Tiral
CPAP, extubate, or trach collar

Labs

Goal: Information availability *& minimize blood loss*

More Frequent
Q4-Q6: ABG, VBG/SvO_2, Lactate, CBC, Chem
Q12-24: LFT
TEG, Coags

Less Frequent/Daily
Q12-Q24: ABG, CBC, Chem
Q24-Qweek: LFT, Coag
Pedi Tubes

Normal (As Needed/Intermittent)
QOD-QMWF: CBC, Chem
Qweek: LFT, Coag
PRN Labs only

Sleep

Goal: Minimize Delirium

Goal 8 hours
Avoid awakening 8 hrs at night
Day/Night Cycle, *Sleep aid*

Goal 4 hours
Avoid awakening 4 hrs at night
Day/Night Cycle, Ear Plugs

As Able
Day/Night Cycle

Monitoring

Routine monitoring (Tele, SpO2, RR, NBP) Plus

Continuous, More #, More Invasive + Routine
A-Line, CVP, CO/CI+SVR/SVRI, $EtCO_2$,
Abdominal Pressures, TTE/IVC measurement

Routine
$EtCO_2$,
A-Line, ±CVP

Less, Less Invasive
Decrease NBP measurements overnight
Remove Foley

Rehabilitation

None or As Able
None or ROM/Positioning Q2hrs
Splinting

As Tolerated to Maintain or Improve Function
General Progression: ROM -> Bed-to-Chair Position/Cardiac Chair -> Danlge/Tilt/Stand
Splinting

Improve Function
to March/Walk -> Outside!
Splinting

Nutrition

Goal: Minimize loss of lean mass

Holding Enteral Feed,
Consider TPN

Enteral Feeds
Trophic Rate

Full Support
Enteral

Full Support
Enteral and PO including supplements

Self-Feeding
PO and supplements

Fluid Goal

Goal: Maintain organ perfusion; Avoid volume overload

Targeted Resuscitation/No over resuscitation
Give fluids only to achieve defined goal
Lactate decrease by 10% in 4 hrs
$ScvO_2$ > 70%, UOP > 0.5ml/kg/hr
Blood and Colloids to avoid over resuscitation

Targeted Management for Euvolemia
Assess intravascular volume status daily
Define Goal of Positive, Negative, or even
Fluid challenge
Diuretic challenge

Self-Management of Fluid Balance
No maintenance fluids

Access

Date of Insertion_____

Adequate access
Central line ≥ 3 ports, A-Line
Swan-Ganz

Balance access & Infection
≥ 2 Ports
Remove arterial line

Minimize Infection
Peripheral, 1-2 Ports
PICC

Wound Care

Perform Daily WC Early with as Many Assistants as Possible

Daily Showers with wound Care and as Many Assistants as Possible

Wound Care Less Often with Fewer Assisting

Simple or Self-care

Medications

Goal: **Minimize polypharmacy**

Scheduled + PRN
More IV + Some Enteral

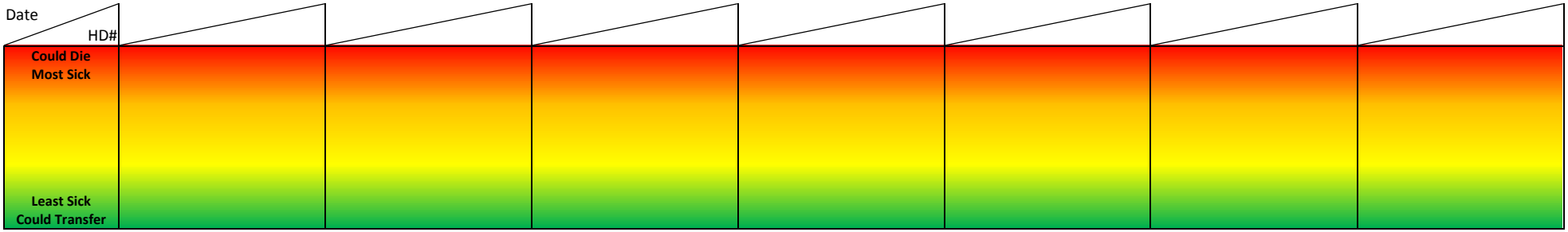
More Enteral/PO Scheduled + IV PRN
Some PO

More PRN
More PO
Some Enteral

C. Team View

Patient Severity of Illness, Status, and Goals

Severity of Illness *(transfer from scales tool)*



Status

% Open							
% Feeding Achieved							
Biggest Issue							
Coordinating Activities *See code list behind Scales Tool for codes.*							

Update Checklist items daily!

	NA	Good	Discuss
GI Prophylaxis	☐	☐	☐
CHG Prophylaxis	☐	☐	☐
HOB > 30 degrees	☐	☐	☐
DVT Prophylaxis	☐	☐	☐
Last BM < 48 hrs ago	☐	☐	☐
Respiratory Orders Current	☐	☐	☐
Family has questions	☐		☐
Delirium Positive	☐		☐
Pending Cultures	☐		☐

Antibiotic(s) NA ☐	*Effective Start Date*	*Planned Stop Date*	*Diagnosis*

Goals *(completed during rounds)*

Fluid volume goal for today:

☐ Positive

☐ Negative

☐ Even

Major Goal(s) for next 24-48 hours (*Star Primary Goal*)

Priorities of care to achieve these goals

Dallas Site Tools

1. Original Team View
2. Original Scales/Checklist Tool

Team View

Patient Severity of Illness, Status, and Goals

Severity of Illness *(transfer from scales tool)*

Allergies

Code Status

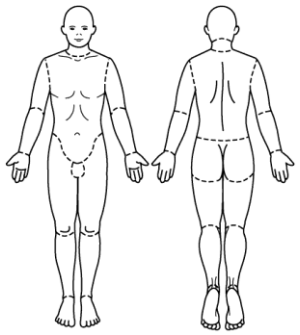
Date																					
Hosp. Day/ICU Day	/1	/2	/3	/4	/5	/6	/7	/8	/9	/10	/11	/12	/13	/14	/15	/16	/17	/18	/19	/20	/21
Could Die Most Sick																					
Least Sick Could Transfer																					

Status

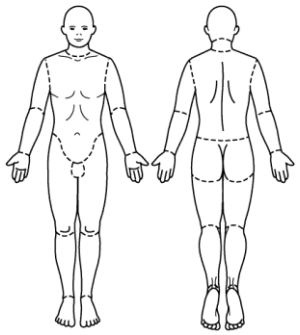
Place "X" or description where these occur and *circle* planned events

% Open																					
OR																					
Dressings "Down-Day"																					
% Feeding																					
Central Line																					
Arterial Line																					
Foley																					
BM																					
Cultures																					
Other Events (e.g. family meeting, etc.)																					

Major Problem List



Draw Current Wounds



Indicate Wound Care

Antibiotic(s)	*NA* ☐	*Start Date/Stop Date*	*Diagnosis*

Recommendations/Messages

Goals *(completed during rounds)*

Fluid volume goal for today:

☐ Positive _____ L

☐ Negative _____ L

☐ Even = + _____ L

The most important goal(s) for today (what we must do to be successful):

Priorities:

___ Wound Care ___ Rehab

___ Procedure(s) ___ Imaging

___ Other_____

Tool 1. Patient's Current Condition

***Instructions**: Mark appropriate boxes below. Use the "average" of checked boxes to identify the Illness Severity (summary assessment). Transfer global assessment to TeamView and use to identify the appropriate Treatment Checklist.*

Step 1

Acuity	☐ Worse ☐ Very Complex — ☐ Standard or Decreasing/Moderate ☐ >>>Getting Better>>>>>>>>>>>>>>>>>>>>> — ☐ Minimal/Low Complexity
Rounds	☐ MD rounding ≤ Q2 hrs!
Drips	☐ 8-9 Drips — ☐ 2-7 Drips
Labs	☐ Q4-6 hr labs, > 6/day — ☐ Q6-8 hr labs, 4-6/day — ☐ Q12-24 hr labs/1-3/day
Monitoring	☐ CO Monitoring, EtCO2 — ☐ Arterial Line — ☐ Standard ICU (Foley, Tele, SpO2, +/- CVP)
Diagnoses & Problems *Current or Chronic Problems: **Worse** = Increasing in number or severity; **Better** = Decreasing in number or severity*	☐ Bad — ☐ <<< Getting Worse <<< — ☐ >>>> Getting Better>>> — ☐ Same, Baseline
General Condition	☐ Worse — >>>>>Getting Better>>> — ☐ Baseline, Normal, Can Transfer
Organ Failures *Brain, Lungs, Heart, Vascular, Bowel, Liver, Kidney, Coagulation, Skin*	☐ MODS (≥ 3 systems) — ☐ 1-3 systems — ☐ 1-2 Systems — ☐ 1 System — ☐ None or Chronic
Organ support is	☐ Active Resuscitation ○ Volume Loading ☐ Increasing: Ventilator, Vasopressors, CRRT — ☐ Increasing in amount or number — ☐ Decreasing in amount or number ("Weaning") — ☐ None
Medications	☐ More or Increasing ☐ Drips/IVs — ☐ IV PRN — ☐ Decreasing — ☐ PO/Enteral
Labs/ABG/pH	☐ Frequent labs to monitor ☐ Acidosis/Shock/Major Derangement ☐ pH< 7.2, Lactate > 4, SvO2 < 60% ☐ Major e-lyte abnormality (K > 6) — ☐ Daily or more frequent labs that show: ☐ Acidosis, ☐ Electrolyte abnormality(ies), ☐ coagulopathy, ☐ anemia, or ☐ changing organ function (better or worse) — ☐ Daily, less frequent, or PRN labs that are Normal or Baseline
Mechanical Ventilation *Goal/Plan*	☐ Increasing Support ☐ High Mean Airway Pressure — ☐ CPAP/PS — ☐ Decreasing Support ☐ Breathing Trials
Respiratory Therapy *FiO2/Oxygenation (P:F, SpO2)*	☐ 100% FiO2, P:F < 100, ☐ SpO2 < 90 — ☐ 70-80% FiO2, P:F 100-200 ☐ SpO2>90 — ☐ 40-50% FiO2 P:F >200 ☐ SpO2 > 90 — ☐ < 40% FiO2, P:F > 300 ☐ SpO2 Normal or Baseline
Mental Status	☐ Paralyzed — ☐ Diminished — ☐ Normal on Vent — ☐ Normal, Baseline
Wounds	☐ Bad ☐ Large/Extensive ☐ Deep burns — ☐ Not Bad ☐ Medium Sized ☐ Mixed Burn Depth — ☐ Good ☐ Small/Minimal ☐ Partial Only
Rehabilitation *Goal/Plan*	☐ None — ☐ ROM>>> ☐ Sitting>>> ☐ Stand/Tilt>>> ☐ Walking>>>>>>>>>>>>>>>>
Risk of Worsening	**High = All of the Following** ☐ WBC (> 15/rising or < 4/dropping) ☐ Hypothermic ☐ Worsening Mental Status ☐ Increasing HR or RR, or decreasing MAP — **Medium = Any of the following** ☐ Febrile ☐ Not tolerating rehabilitation ☐ Increasing Gastric Residuals ☐ Increasing Blood Glucose or Insulin Requirement — **Low = All of the following** ☐ Normal/Stable WBC ☐ Normal Temperature ☐ Normal Vital Signs ☐ Tolerating feeding ☐ Stable insulin requirment ☐ Tolerating rehabilitation

Step 2

Illness Severity ***(summary assessment)*** *****Copy to the TeamView*****	Most sick, Potential Demise — Least Sick, Could transfer today

Step 3. *For patients with a Green-Yellow Illness Severity. Review each question. Items that are marked No/Discuss should be discussed with a physician as soon as possible (at least during morning or evening rounds).*

		Yes/NA	No/Discuss
Analgesia & Sedation	Is the patient interactive/participatory in their care?	☐	☐
	Is the patient awake and participatory in their care? If not, how might you get them so?	☐	☐
	Does the patient have minimal pain?	☐	☐
	Is pain controlled per the patient?	☐	☐
	Is the patient primarily on PO/Enteral pain meds with supplemental IV PRN meds?	☐	☐
	Is the patient on NO sedation?	☐	☐
Mechanical Ventilation	Is the patient off the ventilator?	☐	☐
	If not off the ventilator, does the patient need a tracheostomy?	☐	☐
	If the patient is not off the ventilator, did he/she receive a breathing trial today?	☐	☐
	If not off the ventilator, is the patient on CPAP and/or did he/she receive a breathing trial or trach collar trial?	☐	☐
	What O2 Concentration/Support if applicable?	☐	☐
Labs	Is the frequency of all labs daily or none?	☐	☐
Monitoring	Is the patient on no more than standard ICU monitoring (Telemetry, SpO2, Foley)?	☐	☐
	Can you reduce NBP measurements overnight?	☐	☐
	Can you remove the Foley?	☐	☐
Sleep	Is the patient on schedule to maintain circadian rhythm (Day/Night Cycle)?	☐	☐
	Does he/she need a Sleep Aid?	☐	☐
	How long did this patient sleep?	☐	☐
Rehabilitation	Is the patient able to sit and/or stand at the bedside?	☐	☐
	Can you advance the patient's rehab goal to marching, walking, and possibly going to the gym or outside?	☐	☐
Nutrition	If not on a PO diet, is he/she on full enteral feeds?	☐	☐
	What is the diet?	☐	☐
Medications	Is the patient on PO meds only and possibly some enteral or IV PRN meds?	☐	☐
Transition	Is this patient ready to transfer to the ward?	☐	☐
	What needs to be done for the patient in order to transfer him/her to the ward?	☐	☐

	NA	Good	Discuss		NA	Good	Discuss
GI Prophylaxis	☐	☐	☐	Respiratory orders current	☐	☐	☐
DVT Prophylaxis	☐	☐	☐	Wound care order current	☐	☐	☐
CHG Prophylaxis	☐	☐	☐	Family has questions	☐		☐
HOB > 30 degrees	☐	☐	☐	Delirium Positive	☐		☐
Last BM < 48 hrs ago	☐	☐	☐	Restraints	☐		☐

Step 3. *For patients with a Yellow-Orange Illness Severity. Review each question. Items that are marked No/Discuss should be discussed with a physician as soon as possible (at least during morning or evening rounds).*

		Yes/NA	No/Discuss
Analgesia & Sedation	Has the goal of sedation been defined? Arousable or more awake?	☐	☐
	If appropriate, limit sedation to promote ventilator weaning.	☐	☐
	Use APRV, CPAP, or normal tidal volume ventilation if decreasing ventilator support.	☐	☐
	Use volume or pressure control ventilation if the patient is not weaning or is getting worse.	☐	☐
	Consider a daily breathing trial.	☐	☐
	Did the patient receive a daily breathing trial or is one scheduled for today?	☐	☐
Labs	Daily labs.	☐	☐
	Is the patient on the correct/best lab frequency? (Q12-24 ABG, CBC, Chem; Q24-QWeek LFT, Coag)	☐	☐
Monitoring	Is the patient on at least standard ICU monitoring only (Telemetry, SpO2, Foley)?	☐	☐
	Routine ICU Monitoring (A-Line, EtCO2, Telemetry, SpO2, RR, NBP, +/- CVP)	☐	☐
Sleep	Is there a schedule to maintain day/night cycles?	☐	☐
	How long did the patient sleep last night?	☐	☐
Rehabilitation	Is the patient "tilting" or going to cardiac chair?	☐	☐
	Consider sitting at bedside.	☐	☐
	Consider standing/marching/or walking if able.	☐	☐
	Consider standing or walking if able.	☐	☐
Nutrition	Is the patient achieving "full support" (100% of caloric and protein goals) via enteral route?	☐	☐
	If unable to achieve "full support", *consider TPN.*	☐	☐
Medications	Is the patient receiving mostly IV or Enteral plus IV PRN medications?	☐	☐

	NA	Good	Discuss		NA	Good	Discuss
GI Prophylaxis	☐	☐	☐	Respiratory orders current	☐	☐	☐
DVT Prophylaxis	☐	☐	☐	Wound care order current	☐	☐	☐
CHG Prophylaxis	☐	☐	☐	Family has questions	☐		☐
HOB > 30 degrees	☐	☐	☐	Delirium Positive	☐		☐
Last BM < 48 hrs ago	☐	☐	☐	Restraints	☐		☐

Step 3. *For patients with a Orange-Red Illness Severity. Review each question. Items that are marked No/Discuss should be discussed with a physician as soon as possible (at least during morning or evening rounds).*

		Yes/NA	No/Discuss
Analgesia & Sedation	Is the patient on mostly continuous IV analgesia and sedation with additional IV PRN medication?	☐	☐
	Is the patient on enough sedation/analgesia to achieve ventilation/oxygenation goals?	☐	☐
	Is the patient on AC Pressure Control with low tidal volumes or the VDR?	☐	☐
Labs	Is the patient on the correct/best lab frequency? (4-6 ABG, VBG/ScvO2, Lactate, CBC, Chem, Coags; Q12-24 LFT)	☐	☐
Monitoring	The patient should have continuous arterial blood pressure monitoring and continuous cardiac output monitoring.	☐	☐
	Goal is to maximize knowledge: Continuous CO, Arterial Line; Consider abdominal pressures, ScvO2 monitoring, Echocardiography, IVC ultrasound measurement	☐	☐
Sleep	*Consider day/night cycling if able.*	☐	☐
Rehabilitation	Is the patient being positioned and receiving ROM therapy at least every 4 hours?	☐	☐
	Do not prioritize rehabilitation; prioritize other care first.	☐	☐
Nutrition	If shock and holding enteral feeds, consider TPN.	☐	☐
Medications	This patient should be on continuous, titratable IV medications.	☐	☐
	Consider stopping/holding enteral medications.	☐	☐

	NA	Good	Discuss		NA	Good	Discuss
GI Prophylaxis	☐	☐	☐	Respiratory orders current	☐	☐	☐
DVT Prophylaxis	☐	☐	☐	Wound care order current	☐	☐	☐
CHG Prophylaxis	☐	☐	☐	Family has questions	☐		☐
HOB > 30 degrees	☐	☐	☐	Restraints	☐		☐
Last BM < 48 hrs ago	☐	☐	☐				